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Move to Oracle Database 11*g* – The whole Story

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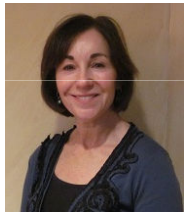

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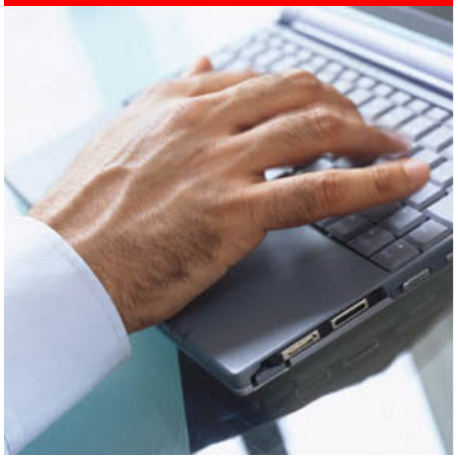
Agenda



- Preparation
- Installation
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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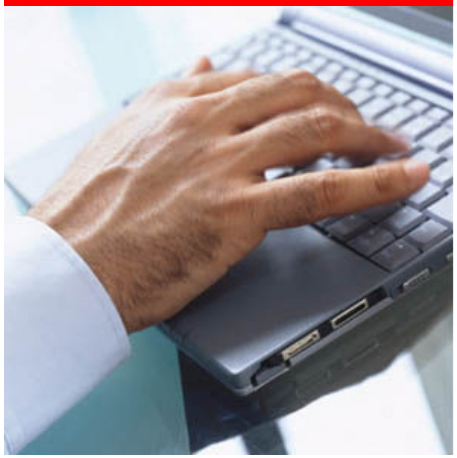
Agenda

- Preparation
  - Support Policy
  - Certification
  - Documentation
  - References
  - Upgrade paths
  - Sanity operations
  - Preparation
- Installation
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices



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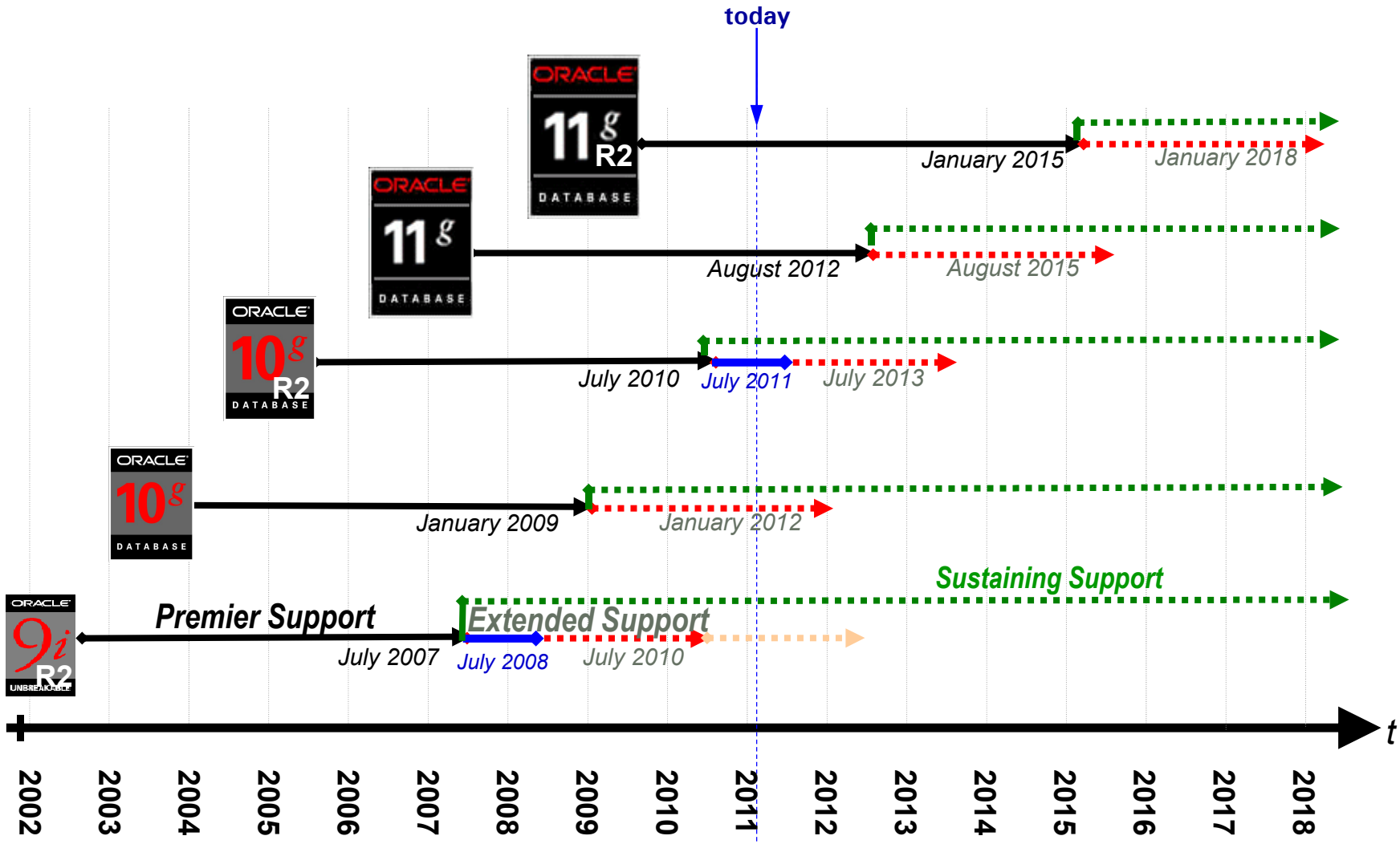
Lifetime Support Policy



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Lifetime Support Policy

Feature	Premier Support	Extended Support	Sustaining Support
Major Product and Technology Releases	✓	✓	✓
Technical Support	✓	✓	✓
Access to Knowledge Base (MetaLink/Customer Connection/SupportWeb)	✓	✓	✓
Updates, Fixes, Security Alerts and Critical Patch Updates	✓	✓	Pre-existing Only
Tax, Legal and Regulatory Updates	✓	✓	No
Upgrade Scripts	✓	✓	No
Certification with existing Third Party Products/Versions	✓	✓	No
Certification with New Third Party Products/Versions	✓	No	No
Certification with new Oracle Products	✓	✓	No

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Lifetime Support Policy

- See: http://www.oracle.com/us/support/lifetime-support/index.html

Oracle Database Releases

Support does not follow the Lifetime Support Policy.

Release	GA Date	Premier Support Ends	Extended Support Ends	Sustaining Support Ends
8.1.7	Sep 2000	Dec 2004	Dec 2006	Indefinite
9.2	Jul 2002	Jul 2007	Jul 2010	Indefinite
10.1	Jan 2004	Jan 2009	Jan 2012	Indefinite
10.2	Jul 2005	Jul 2010	Jul 2013	Indefinite
11.1	Aug 2007	Aug 2012	Aug 2015	Indefinite
11.2	Sep 2009	Jan 2015	Jan 2018	Indefinite

For Oracle Database 9.2 a limited bug fix service will be available from Aug 2010 until July 2012. For details please refer to the Technical Support Policies.

For Oracle Database 10.2 there will be available an additional 2 years of Severity 1 fixes, August 2013 – July 2015 for the Linux Itanium platform. For details please refer to the Technical Support Policies.

For more-detailed information on bug fix and patch release policies, please refer to the "Error Correction Support Policy" on MyOracle Support.

For customers with current support contracts running Oracle Database 10gR2, please refer to the Oracle Technical Support Policies for Extended Support fee waiver information.

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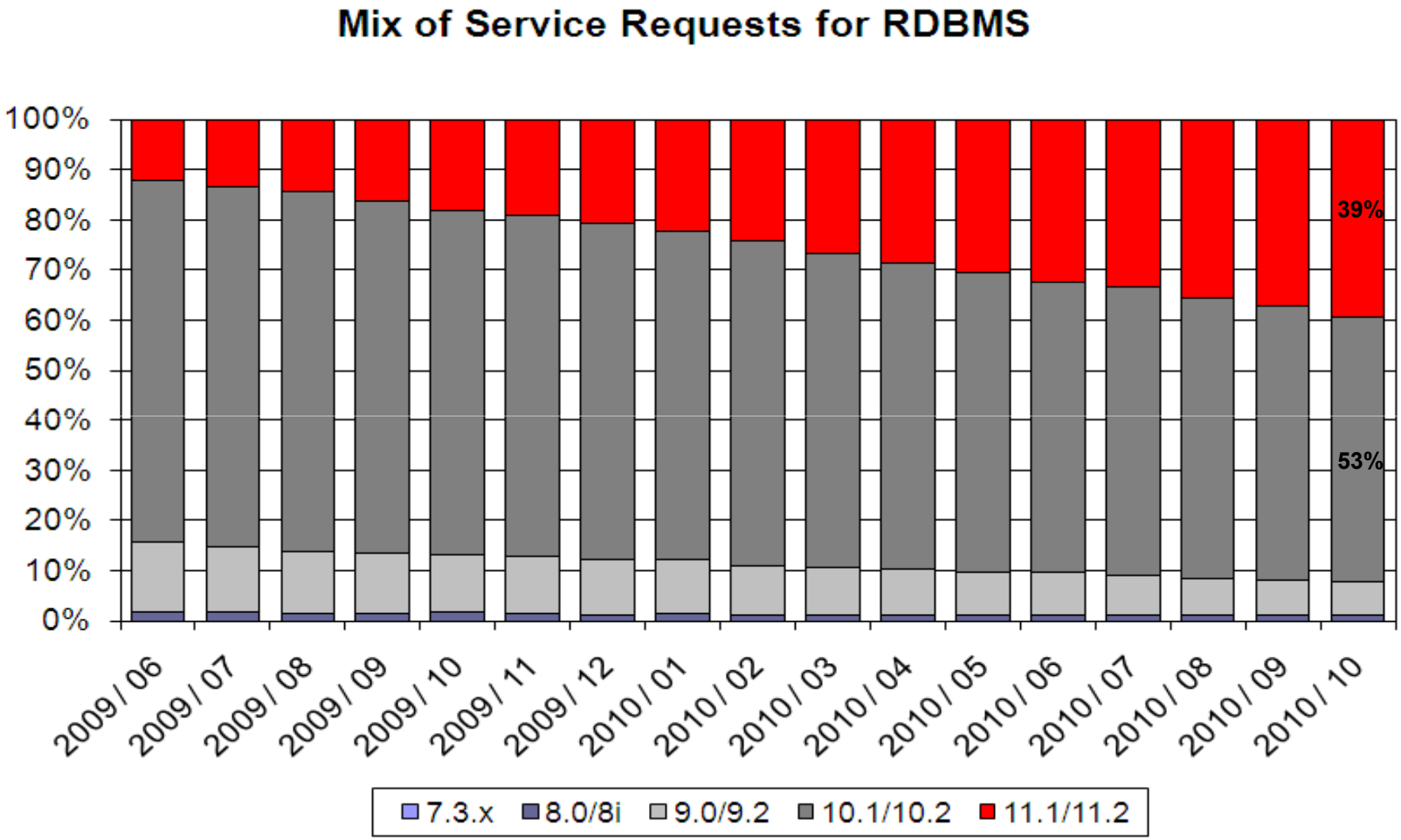
Releases – Support-SRs



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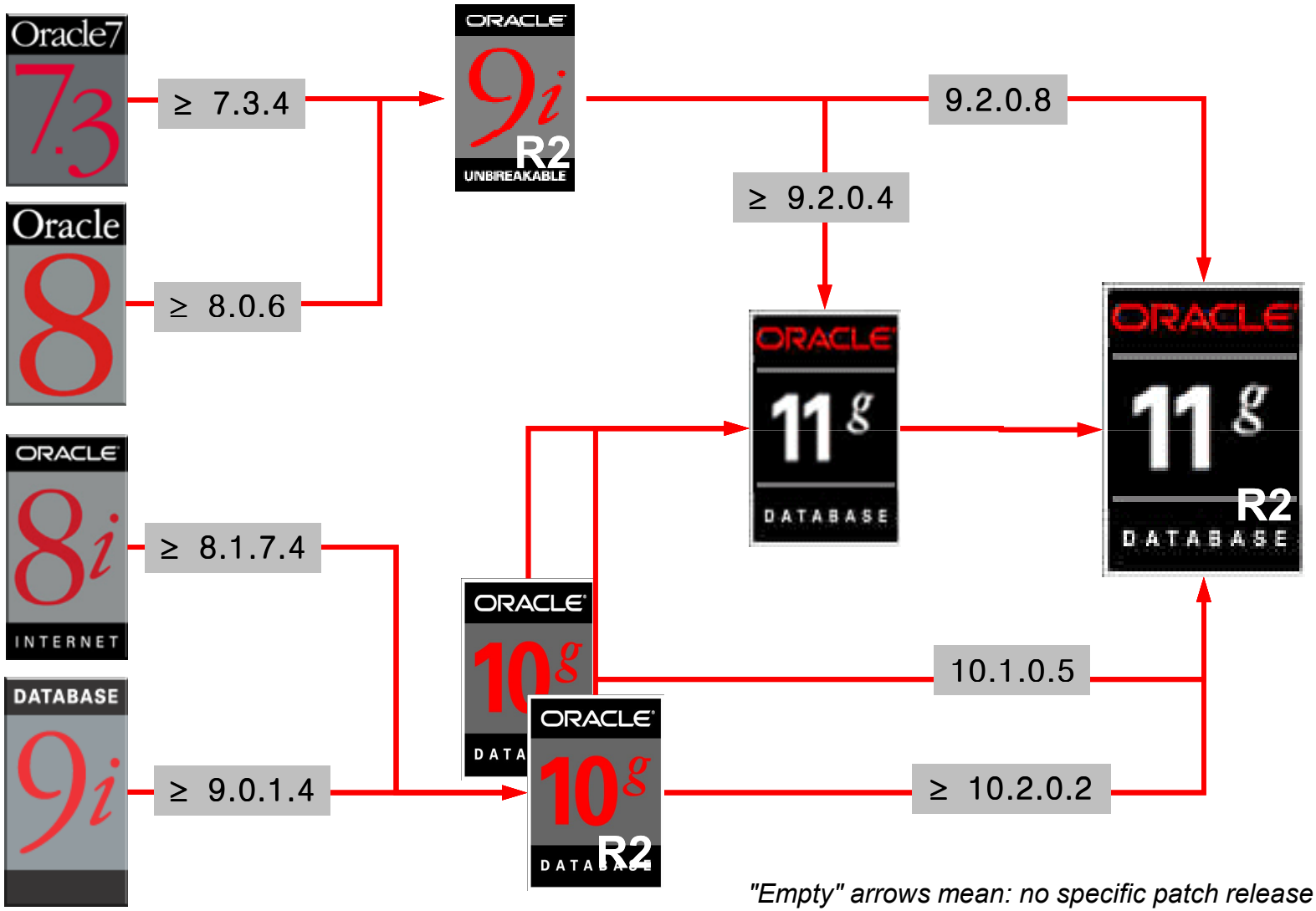
Upgrade to Oracle Database 11g



"Empty" arrows mean: no specific patch release required

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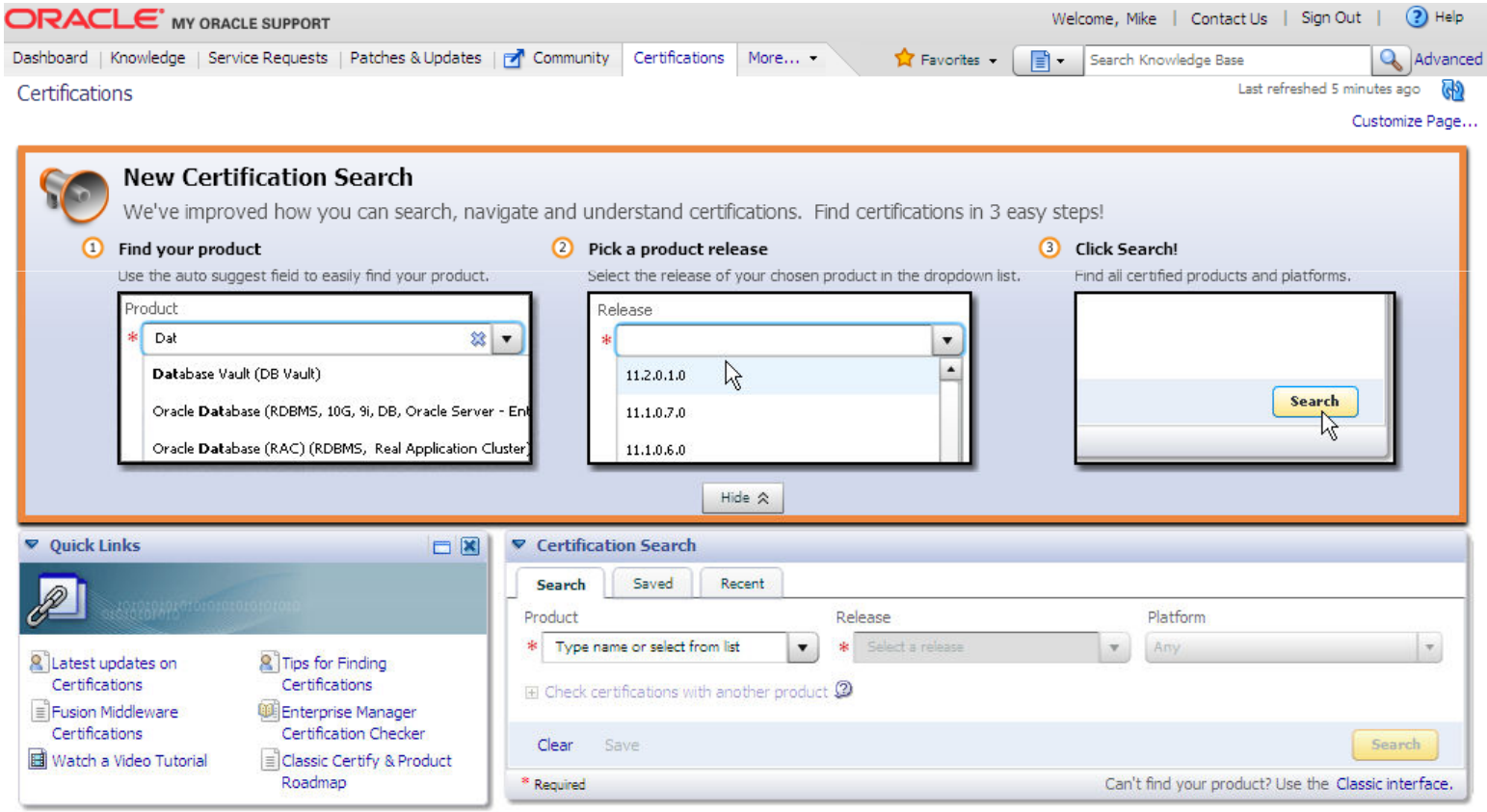
Oracle Certification

- Please see the following MOS notes for explanations on products and product group assignments
  - Note: 964664.1 and Note:431578.1 on Middleware, Application Server



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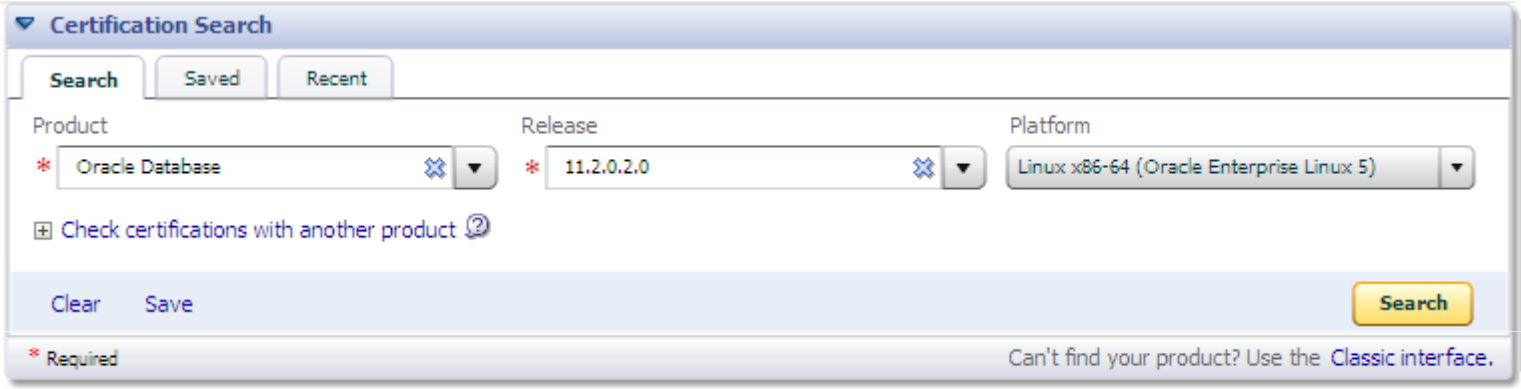
Oracle Certification



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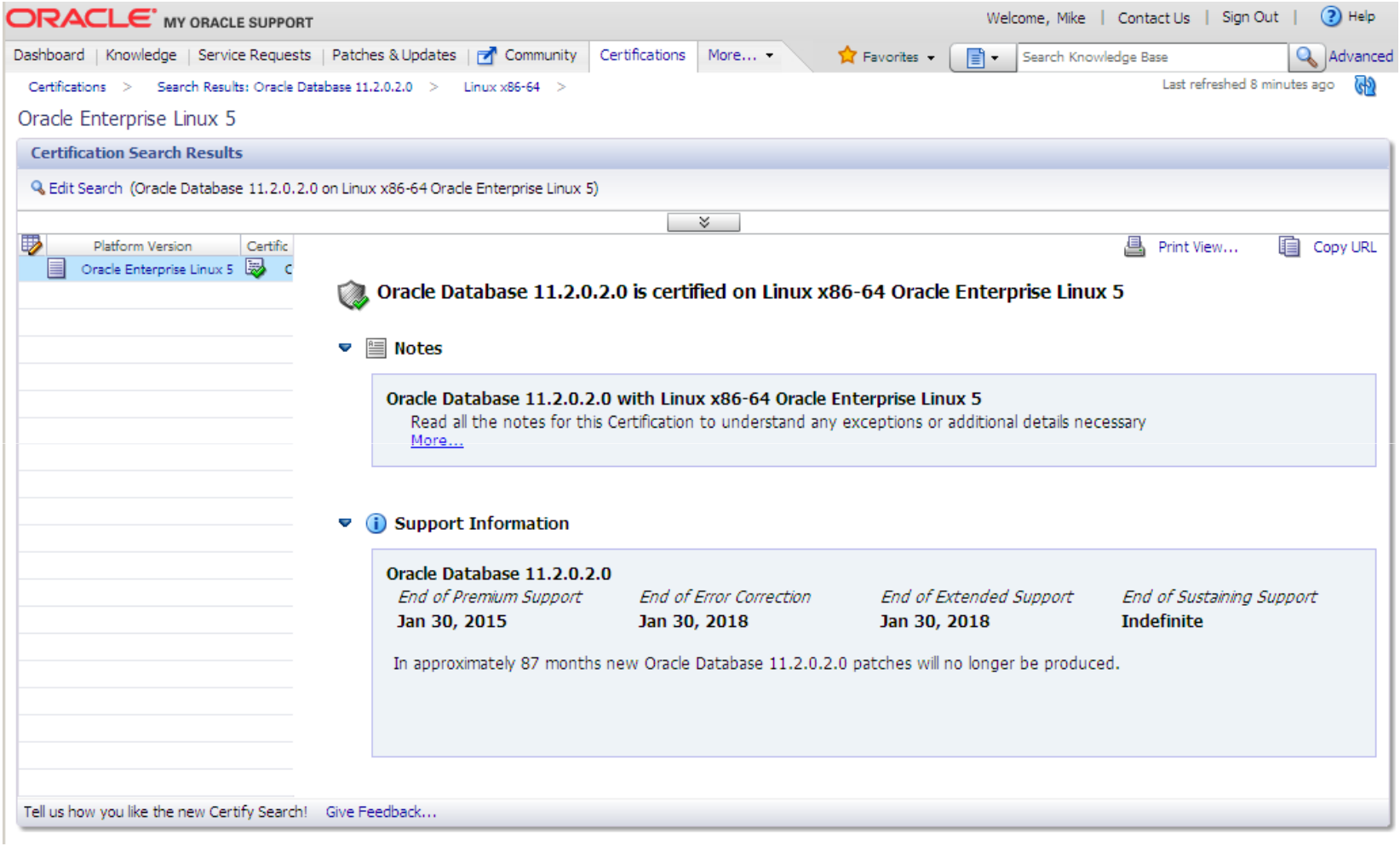
Oracle Certification



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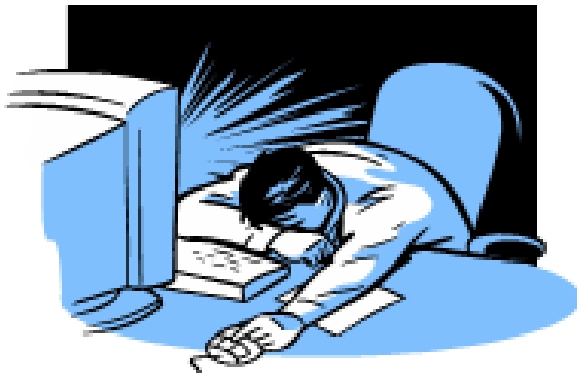
Upgrade Length



- How long will the upgrade take to complete?
  - Independent of:
    - Size of the database
    - Used datatypes
  - Dependent mainly on:
    - The number of installed components and options
    - Valid and non-stale data dictionary statistics
    - Number of synonyms – they'll get recompiled (upgrade from 9*i*)
    - Number of user objects in XDB (upgrade from 10.2)
    - At a very low rate, if `COMPATIBLE` is increased:
      - Number of datafiles
      - Size of redo logs

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Upgrade Length

- Speed up your upgrade performance by:
  - Possibly switch off archiving
    - Make sure this will comply with your business rules
    - Do NOT do this if you are using Standby Database or Golden Gate!
  - Creating dictionary statistics right before the upgrade
    - Oracle 9*i*:

```
SQL> exec DBMS_STATS.GATHER_SCHEMA_STATS('SYS,,
     options => 'GATHER',estimate_percent =>
     DBMS_STATS.AUTO_SAMPLE_SIZE, method_opt => 'FOR
     ALL COLUMNS SIZE AUTO', cascade => TRUE);
```

(Be aware: EXECUTE command does not allow line breaks!!)

    - Oracle 10*g*/11*g*:

```
SQL> exec DBMS_STATS.GATHER_DICTIONARY_STATS;
```

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Upgrade Length

- Speed up your upgrade performance by:
  - Truncate `SYS.AUD$` or populate empty columns prior to the upgrade
    - `TRUNCATE` the auditing table `SYS.AUD$` if audit is on by accident

```
SQL> truncate table SYS.AUD$ drop storage;
```

    - Add columns and populate `DBID` and `NTIMESTAMP#`

For source ≥10g only DBID will have to be populated:

```
DECLARE
 cur_dbid number;
 col_exists EXCEPTION; -- column being added already exists in table
 PRAGMA     exception_init(COL_EXISTS, -1430);  -- ORA-1430
BEGIN
 BEGIN
  EXECUTE IMMEDIATE 'ALTER TABLE SYS.AUD$ ADD (ntimestamp# TIMESTAMP, proxy$sid
NUMBER, user$guid VARCHAR2(32), instance# NUMBER, process# VARCHAR2(16), xid RAW(8),
auditid VARCHAR2(64), scn NUMBER, dbid NUMBER, sqlbind CLOB, sqltext CLOB)';
 EXCEPTION WHEN COL_EXISTS THEN NULL;
 END;
 UPDATE SYS.AUD$ SET ntimestamp#=SYS_EXTRACT_UTC (CAST(timestamp# AS TIMESTAMP WITH
TIME ZONE)) WHERE ntimestamp# IS NULL; COMMIT;
 SELECT dbid INTO cur_dbid FROM v$database;
 EXECUTE IMMEDIATE 'UPDATE SYS.AUD$ SET dbid = ' || cur_dbid || 'WHERE dbid IS NULL';
 COMMIT;
END;
/
```

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Upgrade is easier!

- The upgrade to Oracle Database 11g is much easier than any upgrades to earlier Oracle releases

- Size of Upgrade guides:
  - *8.1.7* - 512 pages
  - *9.0.1* - 484 pages – 111 steps for an RDBMS with 9 components
  - *9.2.0* - 344 pages
  - *10.1.0* - 170 pages
  - *10.2.0* - 140 pages
  - *11.1.0* - 186 pages
  - *11.2.0* -178 pages

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Documentation

- Note:250.1 Upgrade Advisors

Upgrade Advisors

The following upgrade advisors are currently available. Please note that for each advisor there is a specific scope defined. If your environment does not match the listed conditions, please let us know so we can work on expanding our content.

View All | Oracle Database | Fusion Middleware | JD Edwards | E-Business Suite | PeopleSoft | Siebel

Upgrade Advisor	Description	Document
Database Upgrade from 10.2 to 11.2	This document is intended to guide customers on the path to plan for and execute an upgrade of their Oracle Database from Oracle Database 10g release 2 (10.2) to Oracle Database 11g release 2 (11.2). Customers wishing to upgrade from 9.2 Database version (up to 11.2) may consult the Database 9i release 2 (9.2) to Oracle Database 11g release 2 (11.2) Upgrade Advisor [264.1].	251.1
Database Upgrade from 9.2 to 11.2	This document is intended to guide customers on the path to plan for and execute an upgrade of their Oracle Database from Oracle Database 9i release 2 (9.2) to Oracle Database 11g release 2 (11.2).	264.1

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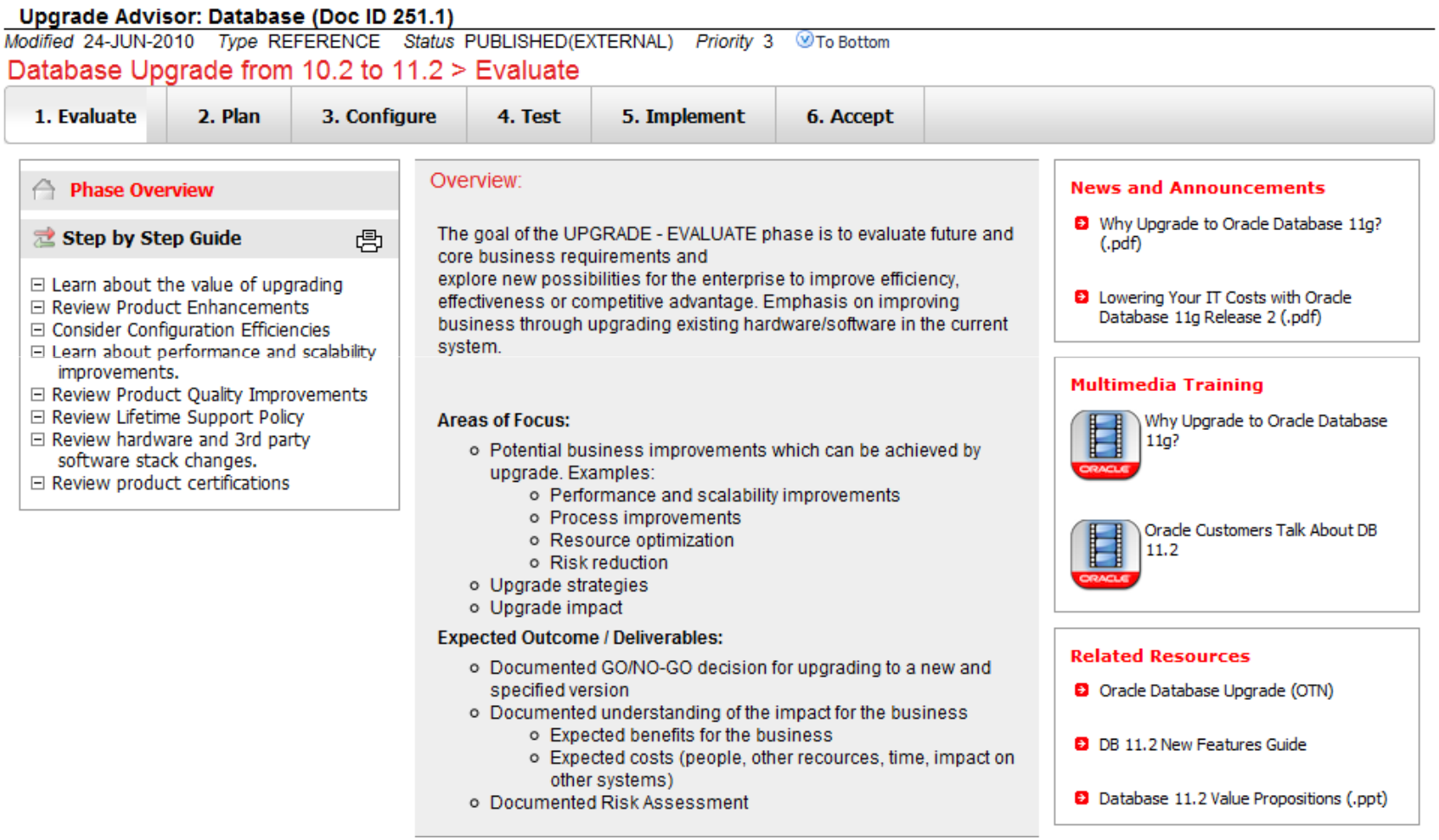
Documentation

- Note:251.1 Database Upgrades from 10.2 to 11.2



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Documentation

- Note:264.1 Database Upgrades from 9.2 to 11.2

Database Upgrade from 9.2 to 11.2 (Doc ID 264.1)

Modified 09-AUG-2010 *Type* REFERENCE *Status* PUBLISHED(EXTERNAL) *Priority* 3 To Bottom

Database Upgrade Lifecycle Advisor from 9.2 to 11.2 > Evaluate

1. Evaluate | 2. Plan | 3. Configure | 4. Test | 5. Implement | 6. Accept

Phase Overview

Step by Step Guide

- Learn about the value of upgrading
- Review Product Enhancements
- Consider Configuration Efficiencies
- Learn about performance and scalability improvements.
- Review Product Quality Improvements
- Review Lifetime Support Policy
- Review hardware and 3rd party software stack changes.
- Review Product Certifications

Overview:

The goal of the UPGRADE - EVALUATE phase is to evaluate future and core business requirements and explore new possibilities for the enterprise to improve efficiency, effectiveness or competitive advantage. Emphasis on improving business through upgrading existing hardware/software in the current system.

Areas of Focus:

- Potential business improvements which can be achieved by upgrade. Examples:
  - Performance and scalability improvments
  - Process improvements
  - Resource optimization
  - Risk reduction
- Upgrade strategies
- Upgrade impact

Expected Outcome / Deliverables:

- Documented GO/NO-GO decision for upgrading to a new and specified version
- Documented understanding of the impact for the business
  - Expected benefits for the business
  - Expected costs (people, other recources, time, impact on other systems)
- Documented Risk Assessment

News and Announcements

- Why Upgrade to Oracle Database 11g? (.pdf)
- Lowering Your IT Costs with Oracle Database 11g Release 2 (.pdf)

Multimedia Training

- Why Upgrade to Oracle Database 11g?
- Oracle Customers Talk About DB 11.2

Related Resources

- Oracle Database Upgrade (OTN)
- DB 11.2 New Features Guide
- Database 11.2 Value Propositions (.ppt)

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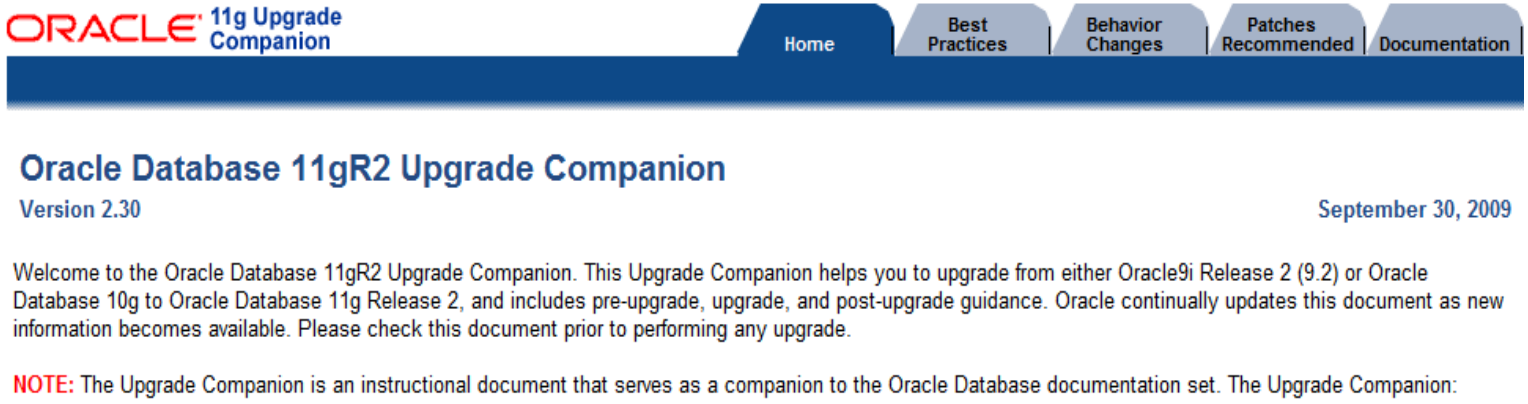
Documentation

- Note:601807.1 Upgrade Companion 11*g*

- Note:785351.1 Upgrade Companion 11*g* Release 2



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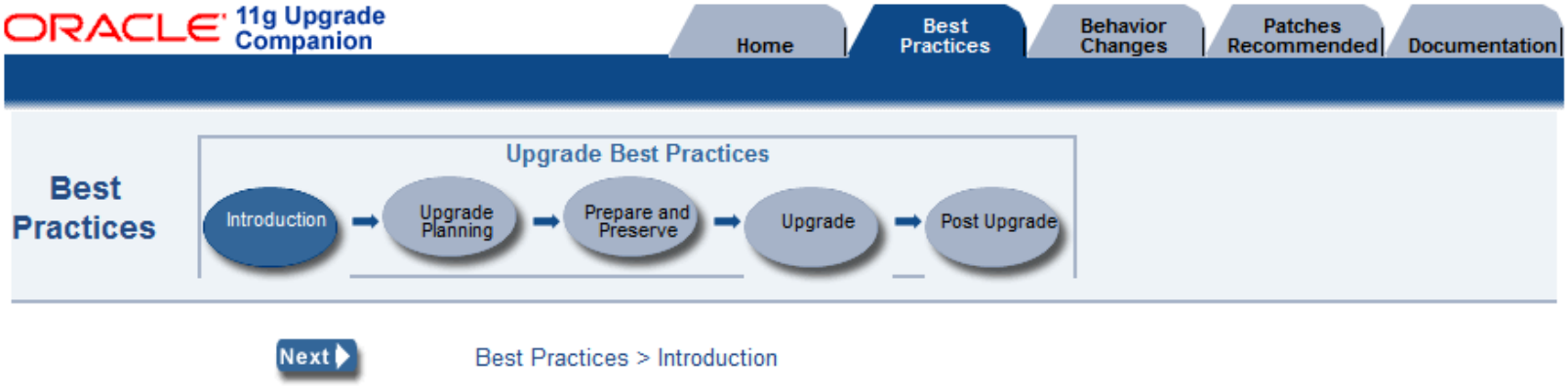
- Note:785351.1 Upgrade Companion 11g



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- Note:785351.1 Upgrade Companion 11g Release 2

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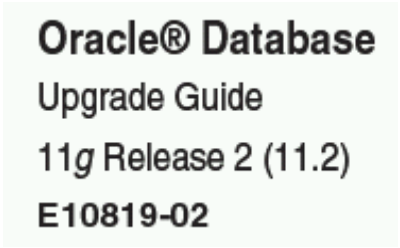
Documentation

- Upgrade Guide
  - 

    http://download.oracle.com/docs/cd/E11882_01/server.112/e17222/toc.htm

- Important Notes
  - Note:837570.1
    Complete Checklist for Manual Upgrades to 11*g* Release 2
  - Note: 421191.1
    Complete checklist for manual upgrades from X to Y
  - Upgrading from 9i to 10g: What to expect from the Optimizer
    http://www.oracle.com/technetwork/database/focus-areas/bi-datawarehousing/twp-bidw-optimizer-10gr2-0208-130973.pdf
  - Upgrading from 10g to 11g: What to expect from the Optimizer
    http://www.oracle.com/technetwork/database/focus-areas/bi-datawarehousing/twp-upgrading-10g-to-11g-what-to-ex-133707.pdf

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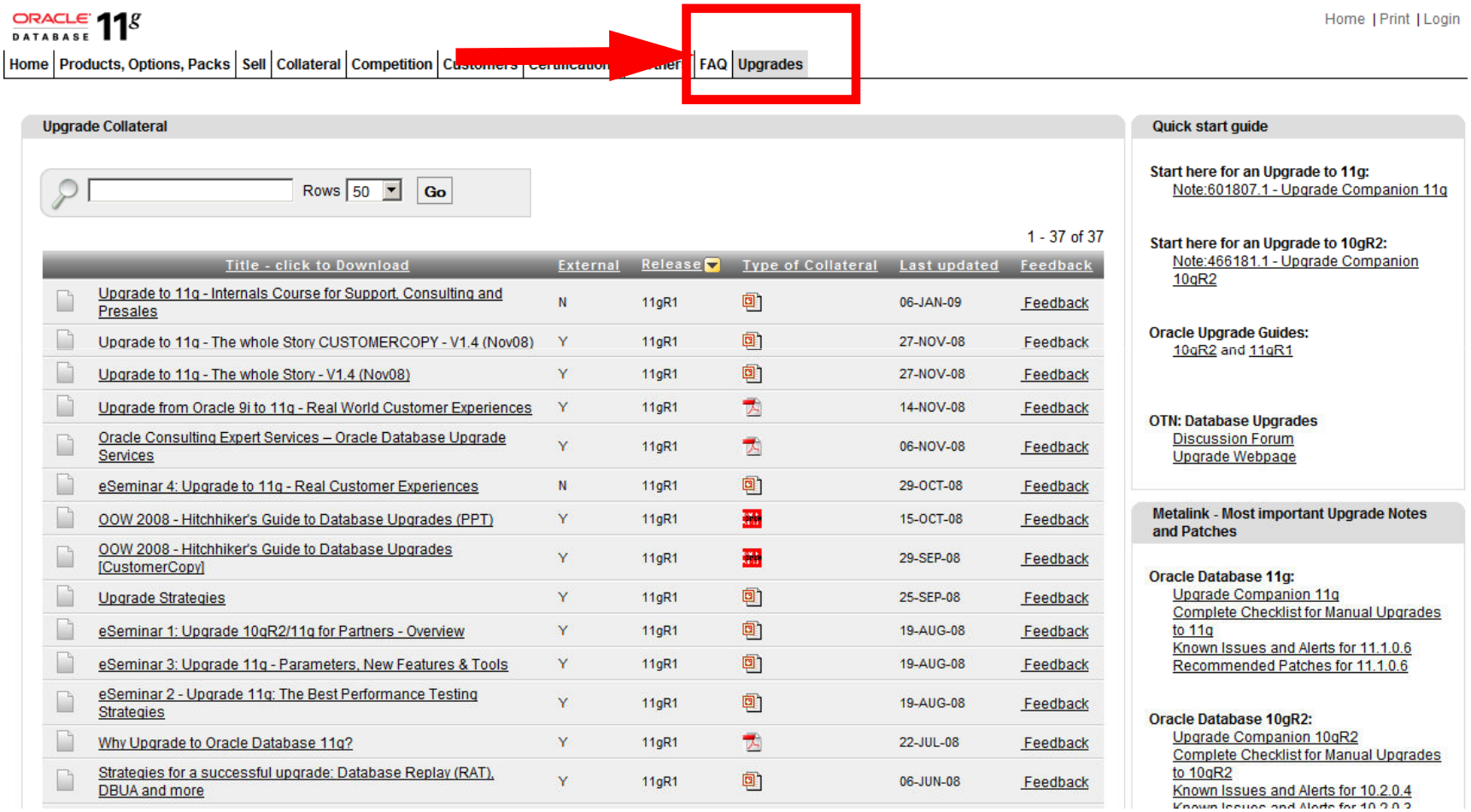
Oracle internal only Upgrade Page

- http://database.us.oracle.com



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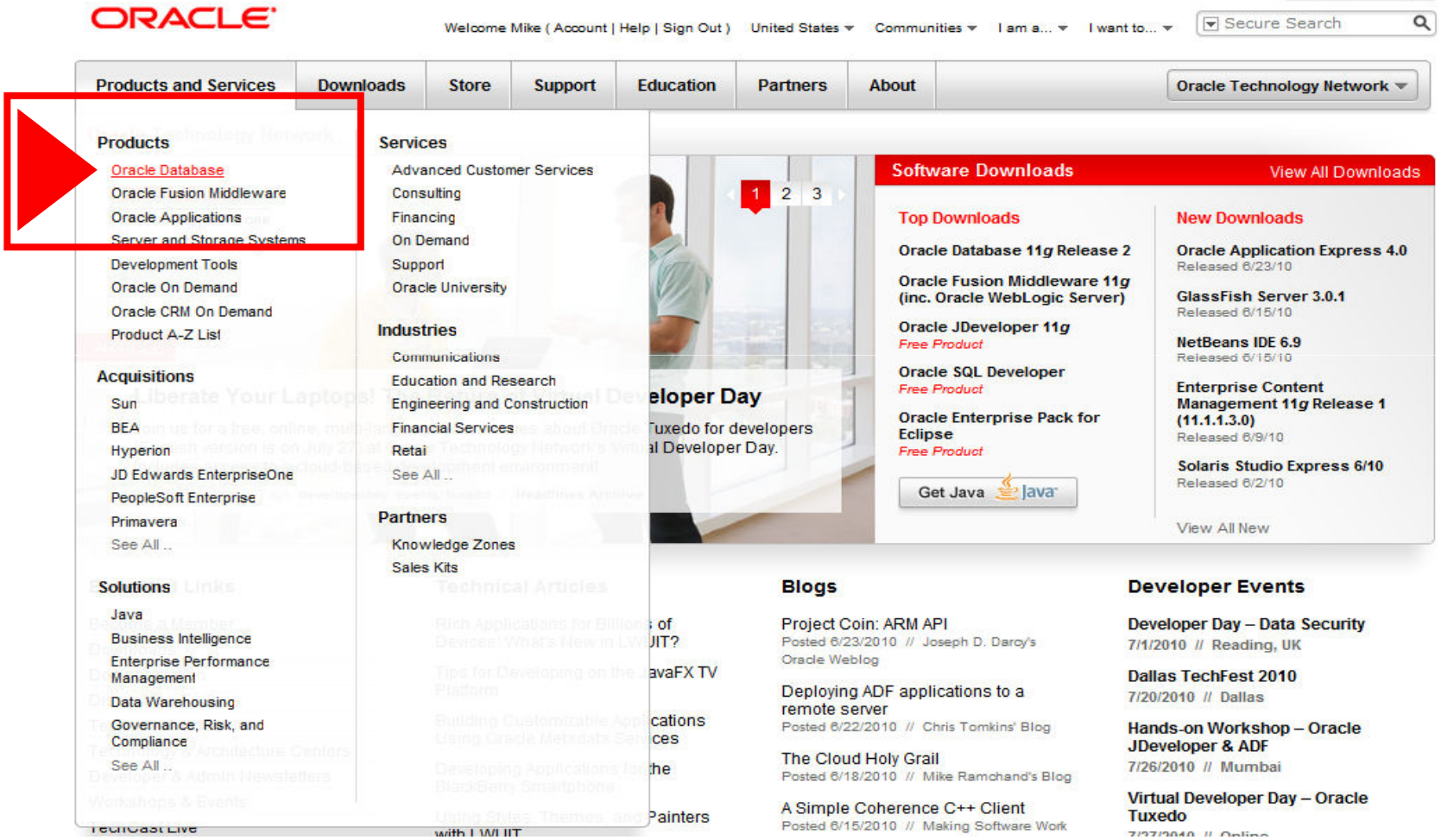
OTN Upgrade Page

- http://www.oracle.com/technetwork/database/upgrade/index.html



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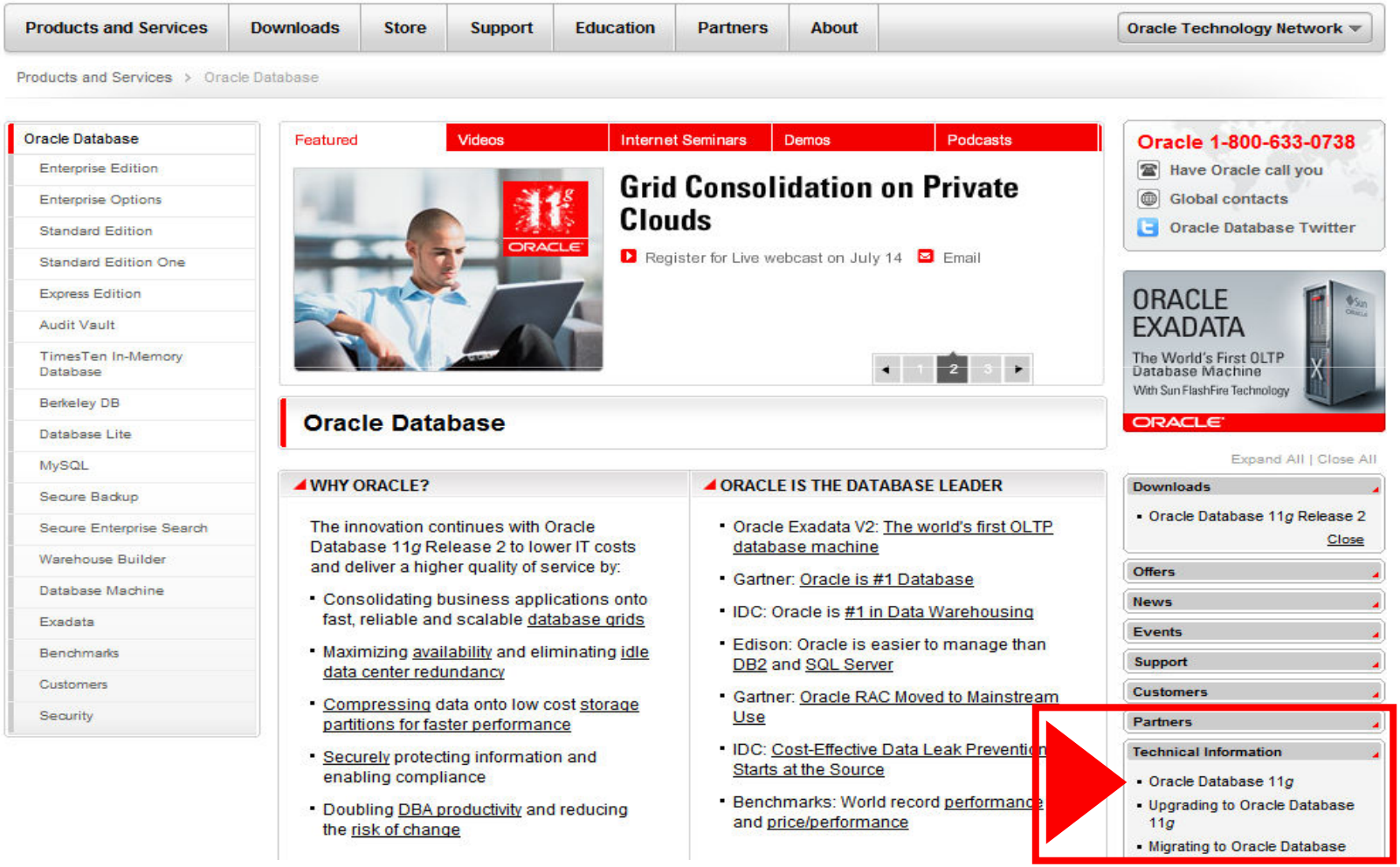
OTN Upgrade Page

- http://www.oracle.com/technetwork/database/upgrade/index.html



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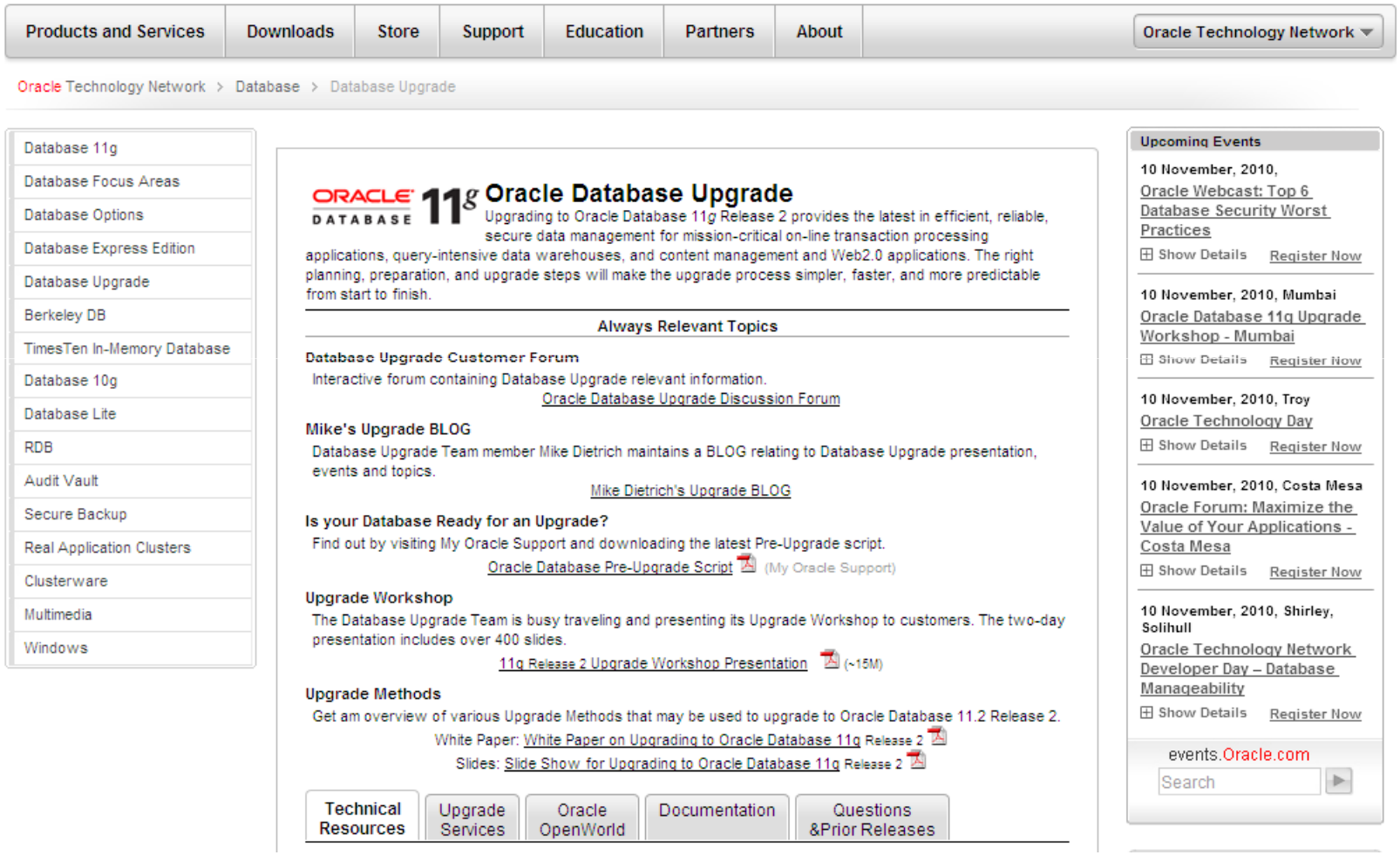
- http://www.oracle.com/technetwork/database/upgrade/index.html



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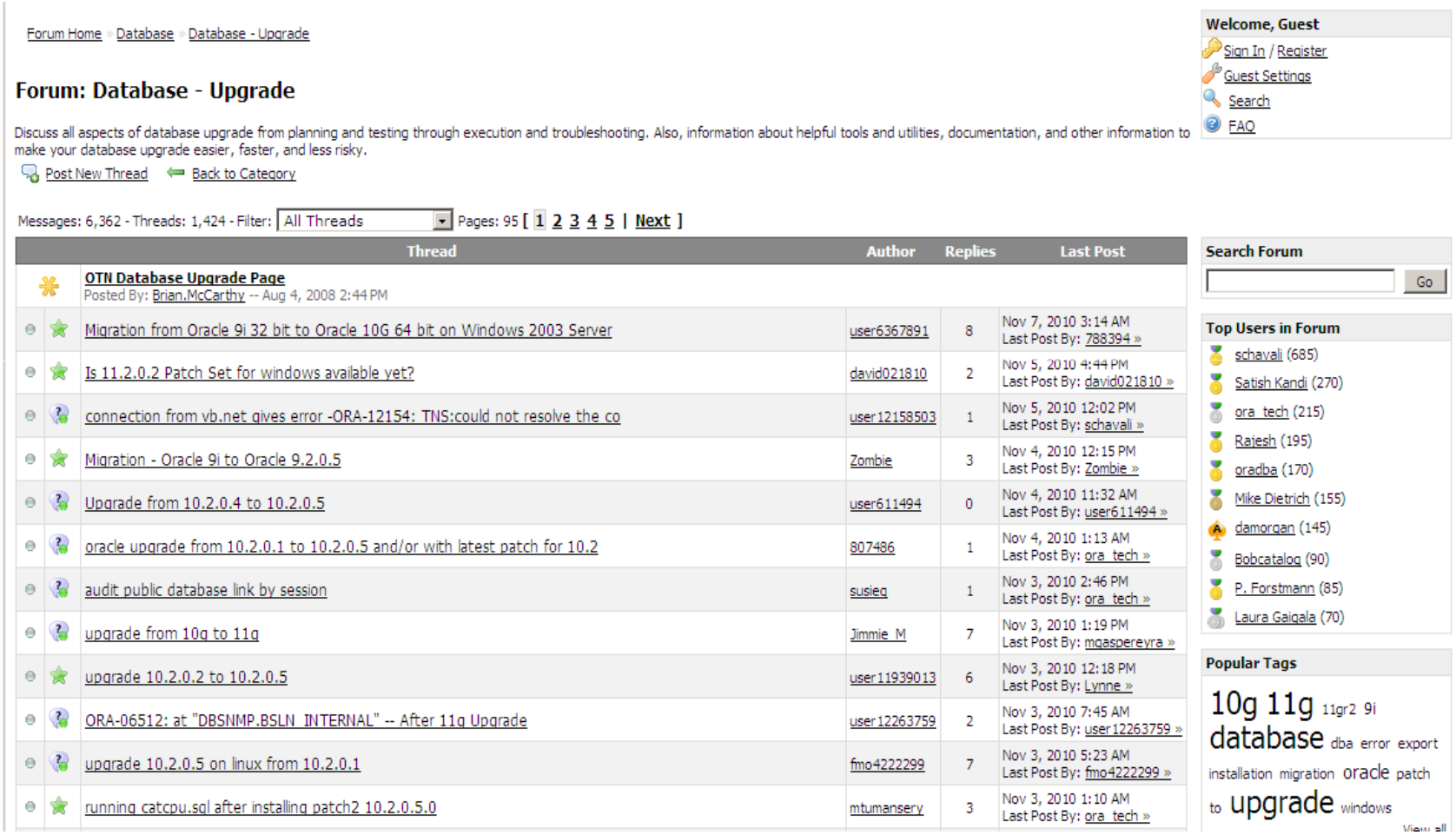
OTN Upgrade Forum

- http://forums.oracle.com/forums/forum.jspa?forumID=583&start=0



Forum Home » Database » Database - Upgrade

Forum: Database - Upgrade

Discuss all aspects of database upgrade from planning and testing through execution and troubleshooting. Also, information about helpful tools and utilities, documentation, and other information to make your database upgrade easier, faster, and less risky.

Post New Thread Back to Category

Messages: 6,362 - Threads: 1,424 - Filter: All Threads Pages: 95 [1 2 3 4 5 | Next]

Thread	Author	Replies	Last Post
OTN Database Upgrade Page Posted By: Brian.McCarthy -- Aug 4, 2008 2:44 PM			
Migration from Oracle 9i 32 bit to Oracle 10G 64 bit on Windows 2003 Server	user6367891	8	Nov 7, 2010 3:14 AM Last Post By: 788394 »
Is 11.2.0.2 Patch Set for windows available yet?	david021810	2	Nov 5, 2010 4:44 PM Last Post By: david021810 »
connection from vb.net gives error -ORA-12154: TNS:could not resolve the co	user12158503	1	Nov 5, 2010 12:02 PM Last Post By: schavali »
Migration - Oracle 9i to Oracle 9.2.0.5	Zombie	3	Nov 4, 2010 12:15 PM Last Post By: Zombie »
Upgrade from 10.2.0.4 to 10.2.0.5	user611494	0	Nov 4, 2010 11:32 AM Last Post By: user611494 »
oracle upgrade from 10.2.0.1 to 10.2.0.5 and/or with latest patch for 10.2	807486	1	Nov 4, 2010 1:13 AM Last Post By: ora_tech »
audit public database link by session	susieq	1	Nov 3, 2010 2:46 PM Last Post By: ora_tech »
upgrade from 10g to 11g	Jimmie_M	7	Nov 3, 2010 1:19 PM Last Post By: mqaspereyra »
upgrade 10.2.0.2 to 10.2.0.5	user11939013	6	Nov 3, 2010 12:18 PM Last Post By: Lynne »
ORA-06512: at "DBSNMP.BSLN_INTERNAL" -- After 11g Upgrade	user12263759	2	Nov 3, 2010 7:45 AM Last Post By: user12263759 »
upgrade 10.2.0.5 on linux from 10.2.0.1	fmo4222299	7	Nov 3, 2010 5:23 AM Last Post By: fmo4222299 »
running catcpu.sql after installing patch2 10.2.0.5.0	mtumansery	3	Nov 3, 2010 1:10 AM Last Post By: ora_tech »

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Laura Gaigala (70)

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Upgrade Blog: blogs.oracle.com/UPGRADE

Upgrade your Database - NOW!

Ease your Oracle Database upgrades - Best Practices, Workshops, Projects ...

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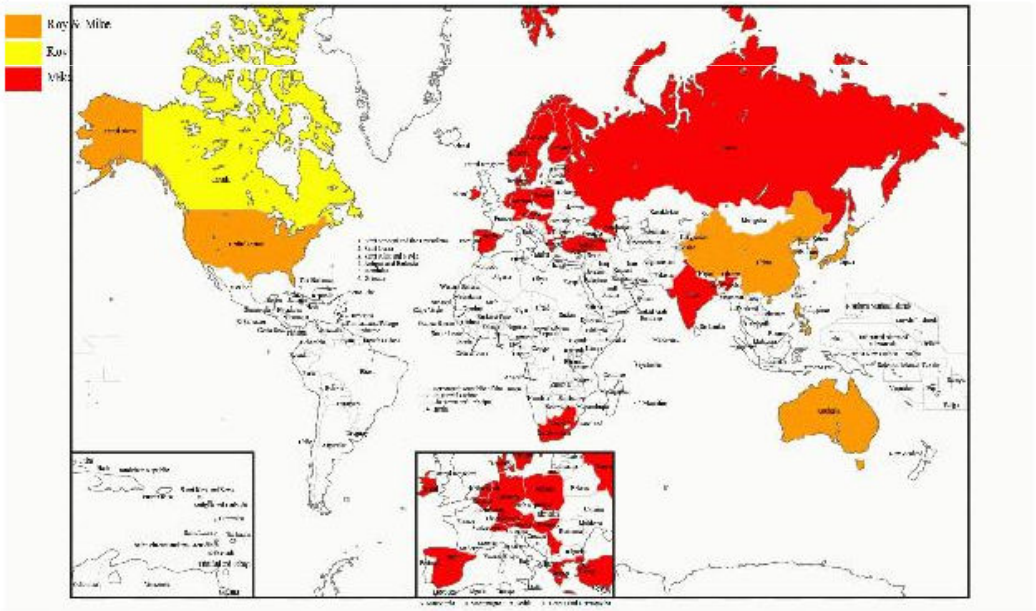
Thank you for your support throughout 2010!!!

By Mike Dietrich on December 23, 2010 6:40 PM

Now as the calendar year **2010** is close to its end, it's time for a quick wrap-up. The TV stations have shown all their flashbacks already in early December but we'll wait until end of the year ;-)

I will post some **pictures** done by Roy or me throughout our travel in the next days. We've visited a lot of countries - and did **more than 60 full-day Upgrade Workshops** in **28 different countries:**



About

Mike Dietrich
Consulting Member Technical Staff
Database Upgrade Development
ORACLE Corporation

Working out of the **Oracle's** Munich office in Germany acting as interlink between customers and Oracle's **Upgrade Development**.
You'd like to connect with me?
LinkedIn or **XING** :-)

Slide Downloads

Upgrade to Oracle 11.2
Upgrade Workshop +500 Slides
Keyword: **upgrade112**

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Anybody live on Oracle Database 11g?

- Currently:
  - 96 external Oracle Database 11g Release 2 references systems
  - 91 external Oracle Database 11g Release 1 references systems

Last updated: 21-MAR-2011

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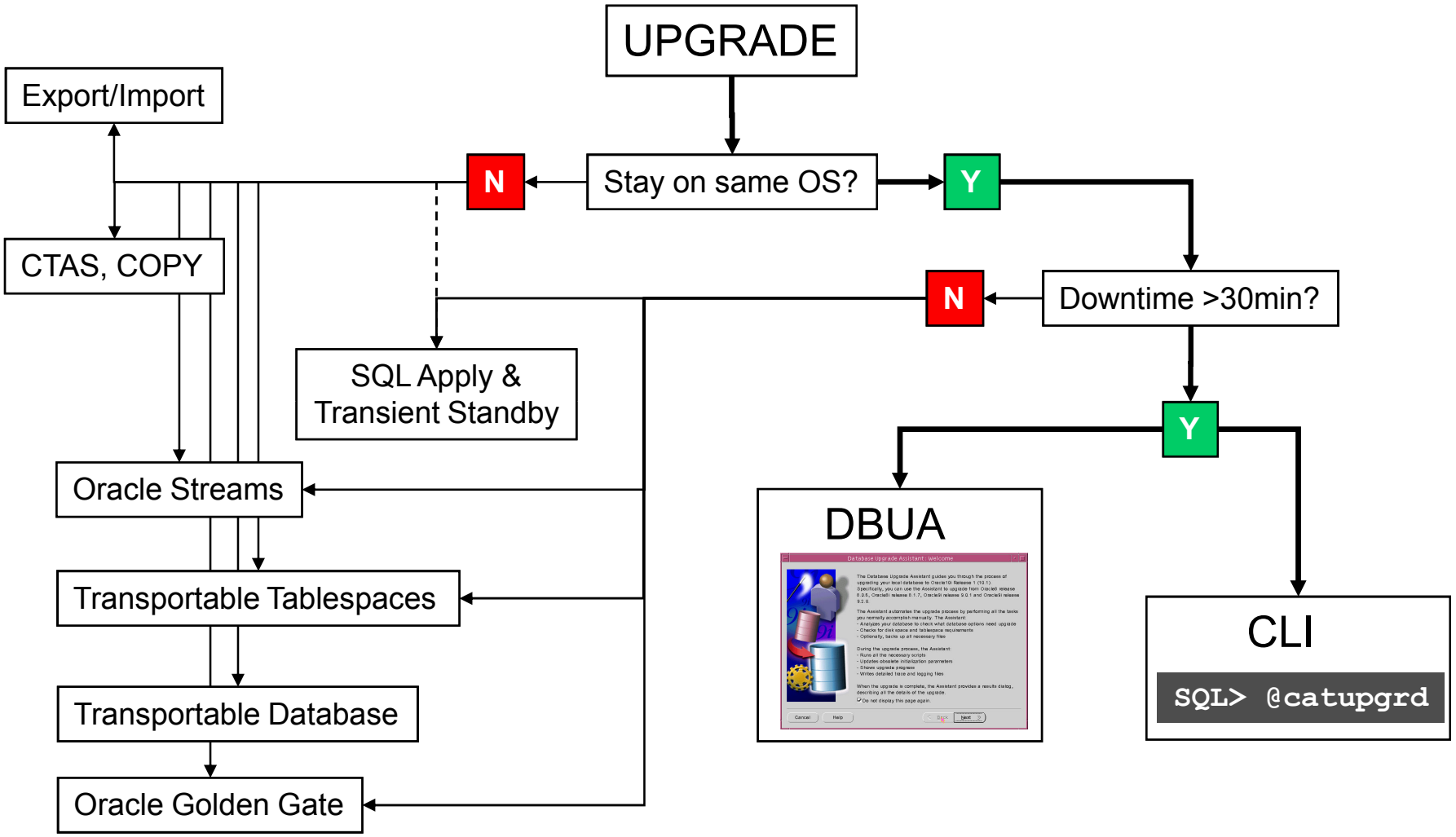
Upgrade Paths



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Sanity Operations

- Always check for INVALID objects:

```
SQL> SELECT UNIQUE object_name, object_type, owner
     FROM dba_objects WHERE status='INVALID';
```

- Fix all INVALID objects **BEFORE** the upgrade!!!!!!

- There should be no invalid objects in SYS and SYSTEM user schema
  - Recompile invalid objects with **`utlrp.sql`** before the upgrade
  - Compare invalid objects from before and after the upgrade
    - Beginning with 11.1.0.7 the comparison has been made easier
    - Run the pre-upgrade check script **`utlu112i.sql`**
    - Afterwards find invalid objects in `registry$sys_inv_objs` and `registry$nonsys_inv_objs`
    - Compare after the upgrade with: **`utluiobj.sql`**
    - The view `DBA_INVALID_OBJECTS` contains a list of invalid objects after the upgrade

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Sanity Operations

- If upgrading from 10g or 11g, purge the recyclebin

```
SQL> purge DBA_RECYCLEBIN;
```

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Sanity Operations

- Remove "old" parameters, underscores and events from your init.ora/spfile
  - Examples:

```
init.ora:
<...>
_always_semi_join=off
_unnest_subquery=false
<...>
optimizer_features_enable=9.0.1
<...>
event = "10061 trace name context forever, level 10"
<...>
```

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Sanity Operations – Real World

- Upgrade of ORDIM component only from 9.2.0.8 to 11.2.
  - These underscore parameters and events were set:

```
_complex_view_merging = FALSE
_multi_join_key_table_lookup = FALSE
_library_cache_advice = FALSE
_index_join_enabled = FALSE
_push_join_union_view = FALSE
_push_join_predicate = FALSE
_always_semi_join = OFF
_pred_move_around = FALSE
_unnest_subquery = FALSE
_predicate_elimination_enabled = FALSE
_eliminate_common_subexpr = FALSE
_no_or_expansion = FALSE
event = '600 trace name systemstate level 10'
event = '600 trace name errorstack level 10'
event = '942 trace name errorstack level 10'
event = '54 trace name systemstate level 10'
event = '54 trace name errorstack level 10'
event = '7445 trace name systemstate level 10'
event = '7445 trace name errorstack level 10'
event = '10195 trace name context forever, level 1'
event = '10778 trace name context forever, level 1`
```

Upgrade time: 49 minutes

Unset underscores and events

Upgrade time: 7 minutes!!

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Preparation

- Switch off DATABASE VAULT (if used/installed)
  - **Oracle® Database Vault Administrator's Guide: Appendix B**
  - Unix: (simplified)
    - Relinking without Database Vault
      `[$ make -f ins_rdbms.mk dv_off ioracle]`
    - `$ chopt disable dv`
  - Windows:
    - Rename `oradv11.dll` in `ORACLE_HOME\bin`
    - Upon restart: `$ chopt disable dv`
  - After upgrading relink with `dv_on` or rename the DLL and enable Database Vault again: `$ chopt enable dv`
  - *Note: This will just work under the assumption that DVSYS and the DV owning user have identical passwords*

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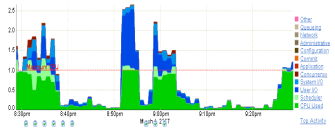
Preparation



- Preserve performance statistics
  - Get accurate performance statistics
    - Comparison: before ↔ after
    - Time specific queries and batches
  - Test upgrade of the database
    - Functional tests
    - Performance tests with real life loads!!!
      - Real Application Testing
        - SQL Performance Analyzer
        - Database Replay

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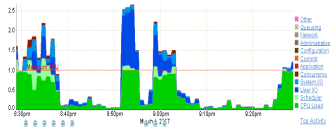
Preparation



- Collecting sufficient performance data prior to the upgrade is of vital importance
  - Sufficient means: Starting at least 4 weeks before the upgrade
  - Gather accurate performance statistics
  - In Oracle 8*i*/9*i*:
    - Use STATSPACK
      - Export the PERFSTAT user right before the upgrade
      - Note:466350.1 STATSPACK before/after upgrade
  - In Oracle 10*g*/11*g*:
    - Use AWR
      - Take snapshots every 30-60 minutes – retention: >30 days
      - Extract the AWR with: `SQL> @?/rdbms/admin/awrext.sql`
      - => For 10.1 only use: `DBMS_SWRF_INTERNAL.EXTRACT_AWR`
      - Use AWR DIFF reports to compare before & after upgrade performance: `DBMS_WORKLOAD_REPOSITORY.AWR_DIFF_REPORT_HTML`
    - Managing Optimizer/CBO stats during upgrade: Note:465787.1

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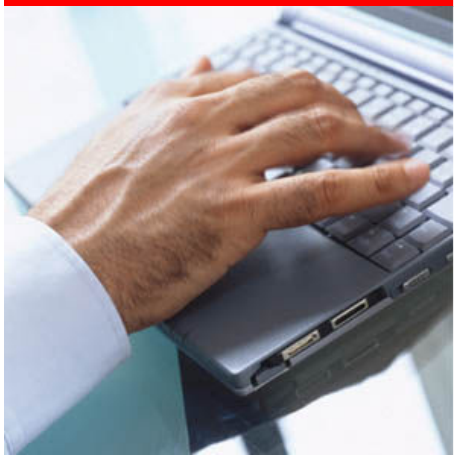
Agenda



- Preparation
- Installation
  - Installation Overview
  - Grid Infrastructure & ASM Installation
  - Patches
  - Time Zone
  - Unattended
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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Installation

- How to access the software?
  - http://edelivery.oracle.com/

  - Download from OTN: http://otn.oracle.com/indexes/downloads/index.html

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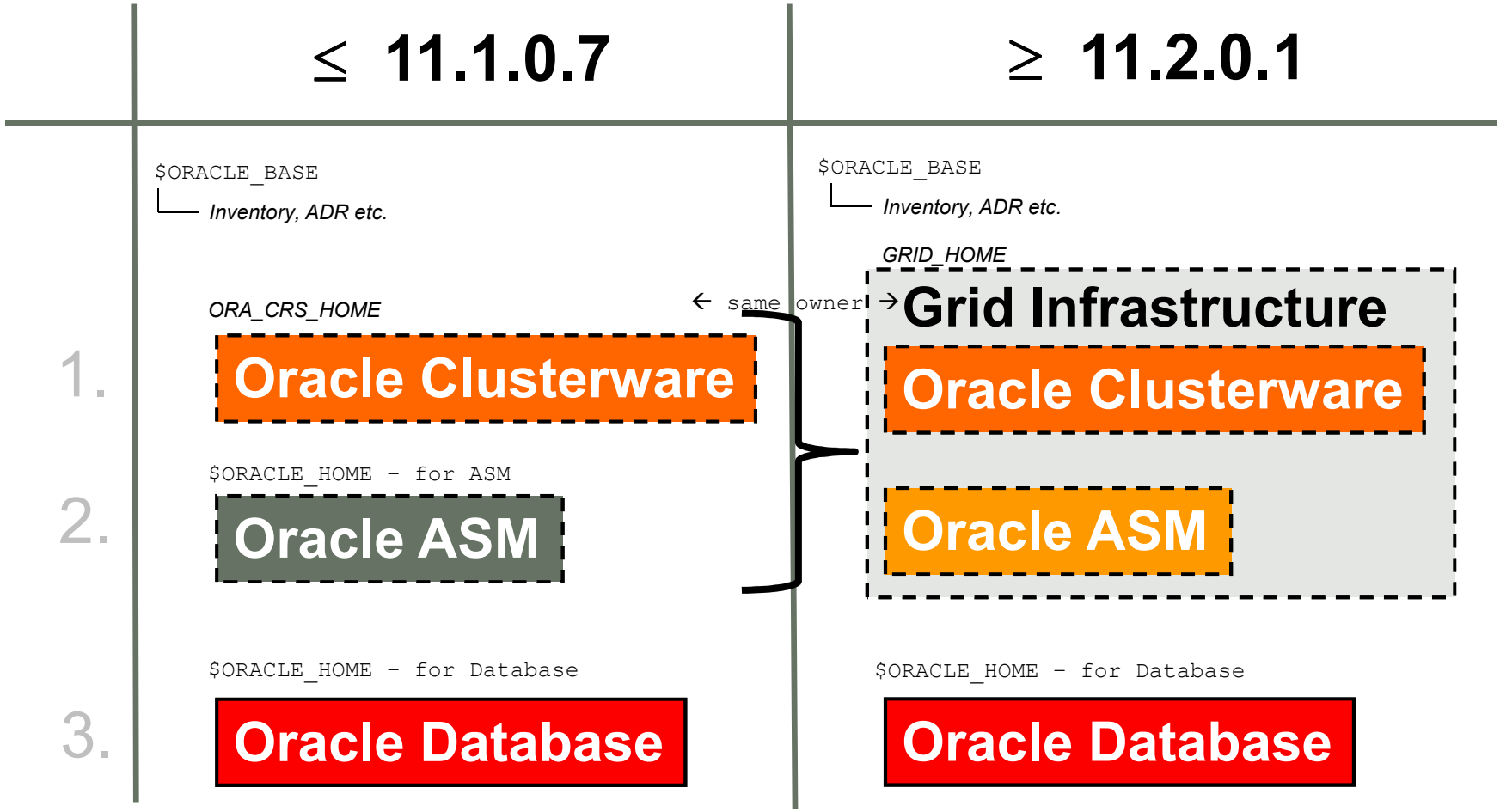
Installation overview



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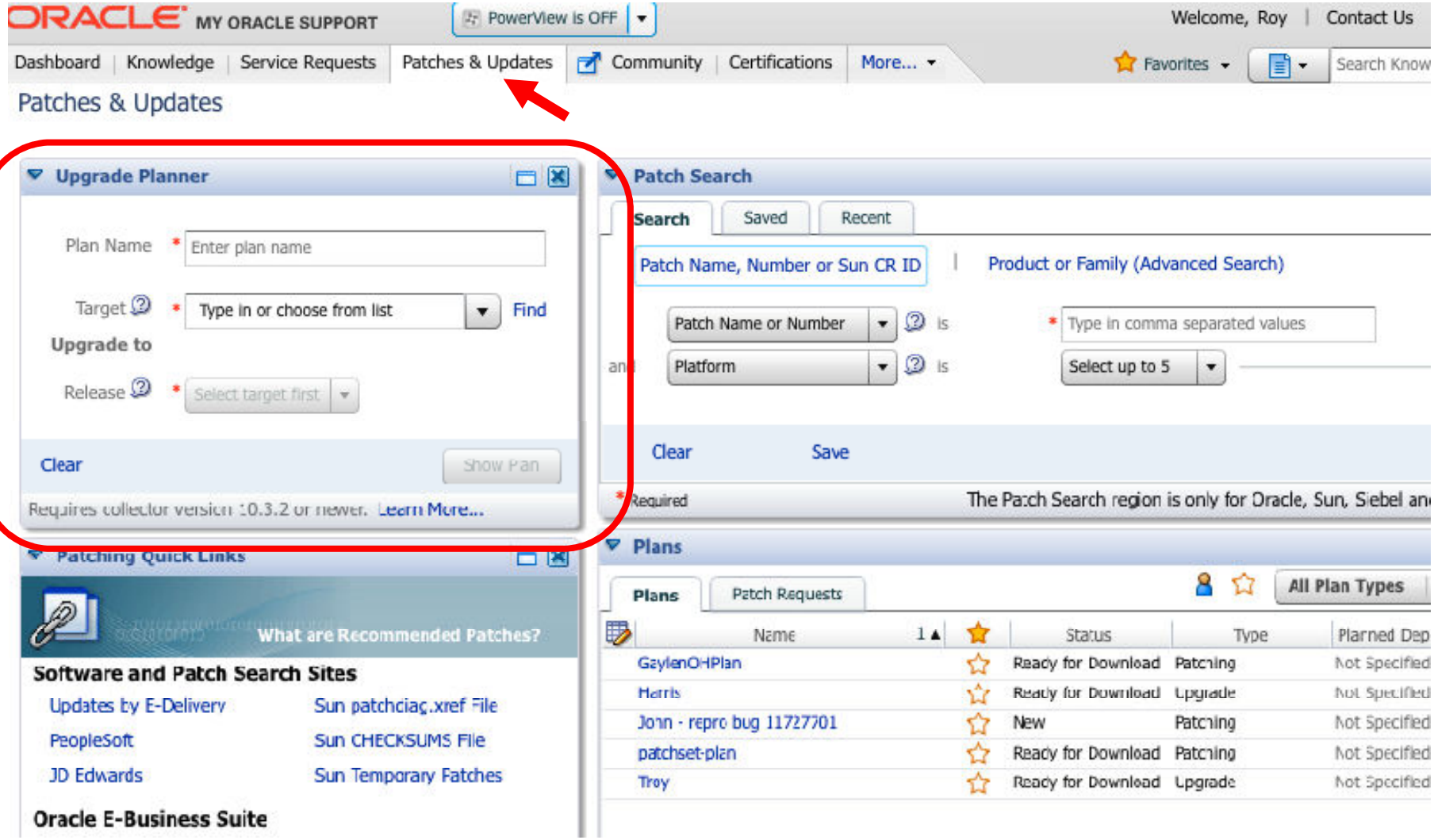
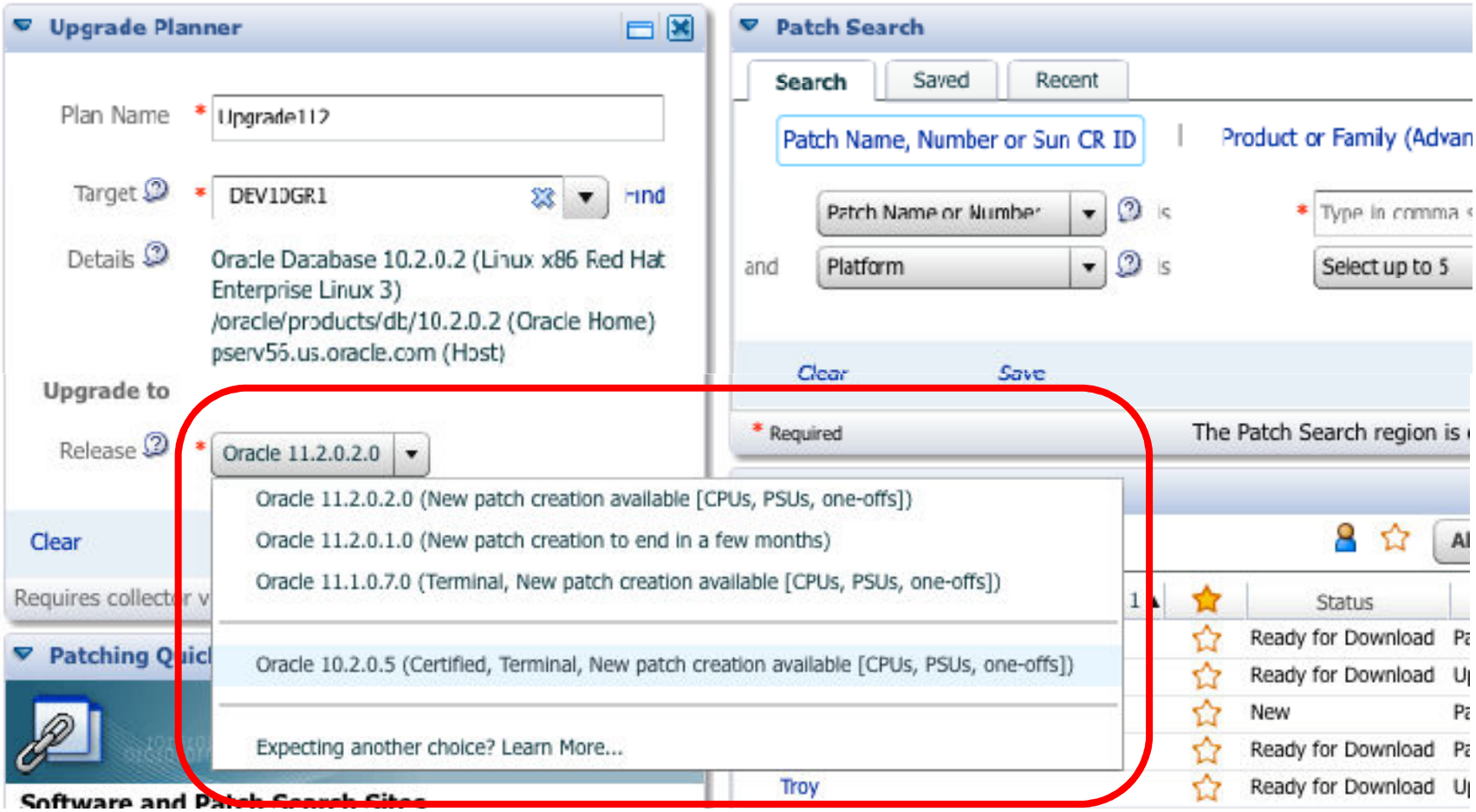
Upgrade Planner

- Accessible on support.oracle.com
- Identify the latest version, patchset, PSU for your platform
- List support information for all available releases
- Add one-off patches to the plan for validation
  - Is the patch included in your new version/patchset?
  - If not, is a new version of the patch needed?
- Download all required software and patches in a single operation
- Requires OCM Collector version 10.3.2 or newer

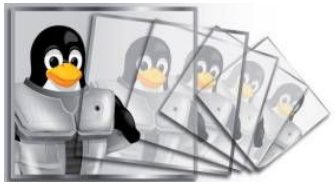
Upgrade Planner



Upgrade Planner



Installation – VMware



- Does Oracle certify software to run on VMware?
  - Please see the following MOS Notes:
    - Note:942852.1
      VMWare Certification for Oracle Products
    - Note:249212.1
      Support Position for Oracle Products Running on VMWare Virtualized Envs.

Support Status for VMware Virtualized Environments

Oracle has not certified any of its products on VMware virtualized environments. Oracle Support will assist customers running Oracle products on VMware in the following manner: Oracle will only provide support for issues that either are known to occur on the native OS, or can be demonstrated not to be as a result of running on VMware. If a problem is a known Oracle issue, Oracle support will recommend the appropriate solution on the native OS. If that solution does not work in the VMware virtualized environment, the customer will be referred to VMware for support. **When the customer can demonstrate that the Oracle solution does not work when running on the native OS**, Oracle will resume support, including logging a bug with Oracle Development for investigation if required. If the problem is determined not to be a known Oracle issue, we will refer the customer to VMware for support. When the customer can demonstrate that the issue occurs when running on the native OS, Oracle will resume support, including logging a bug with Oracle Development for investigation if required.
NOTE: Oracle has not certified any of its products on VMware. For Oracle RAC, Oracle will only accept Service Requests as described in this note on Oracle RAC 11.2.0.2 and later releases.

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Installation – Things to Know: Solaris

- Oracle Database 11.2 on SPARC Solaris requires Oracle Solaris 10 ≥ Update6
  - See Note: 971464.1 for further information, downtime, Live Update etc.:
    FAQ - 11gR2 requires Solaris 10 update 6 or greater

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Installation – Things to Know: AIX

- Memory Footprint for dedicated server processes increased significantly after upgrade to 11g on AIX
  - The additional memory seen allocated to oracle processes in the 11.2 release is a consequence of the additional link options added to the oracle link line, -bexpfull and -brtllib. The two link options were specifically added in 11.2.0.1 to support the online patching feature.
  - Download patch 10190759 from support.oracle.com – this will exchange the make file
  - For further information see Note: 1246995.1

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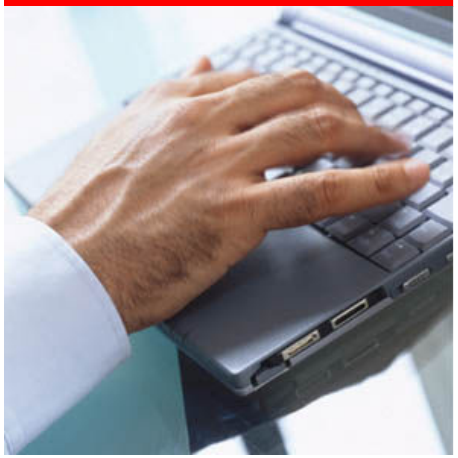
Agenda



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Grid Infrastructure Upgrade 11*g* Release 2

- Always upgrade Oracle Clusterware first!!!
- Upgrading to Oracle Clusterware 11g Release 2:
  - Install new software into new Grid Infrastructure home
  - Out-of-place software upgrade
  - Grid Infrastructure home is owned by 'root'
  - **Make sure** to check Note:948456.1 for known issues
- On 32-bit Windows there'll be no 32-bit Grid Infrastructure and ASM available!

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Grid Infrastructure Upgrade Concept

- Don't set environment variables `ORACLE_HOME`, `ORACLE_BASE` and `ORA_CRS_HOME`
- Rolling Oracle Clusterware upgrade possible:
  - From 10.1.0.5 and ≥ 10.2.0.3:
    Leave Oracle Clusterware running, shutdown nodeapps, ASM, Database Instances
  - From 11.1:
    Upgrade Oracle Clusterware and Automatic Storage Management to 11.2. at the same time
    - ASM 11.1 only is rolling upgradeable
    - ASM can be upgraded later with `asmca -upgrade`
- Non-rolling upgrade:
  - Shutdown entire Oracle stack
- No rolling upgrade possible if Clusterware is installed in a shared FS

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Grid Infrastructure Upgrade Concept

- Out-of-place Software Upgrade
  - New Software is installed into a new Home
  - Current software is left in place and resources requiring it remain running
  - Allows for shorter downtime as we can complete the install before the actual upgrade
  - Goal: Same configuration, new binaries
    - New clusterware features can be adopted later
- Rolling Upgrade (Clusterware/ASM)
  - Deals with the upgrade of resources that utilize a clustered home
  - Normally done after an out of place software upgrade
  - On each node in turn resources are:
    - Stopped
    - Upgraded
    - Restarted

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Grid Infrastructure Upgrade Considerations

- With Oracle Grid Infrastructure 11.2, ASM and Oracle Clusterware are installed into a single home directory, which is referred to as the "Grid Infrastructure home"
  - However, Oracle Clusterware and ASM remain separate products
- The grid infrastructure version must be greater than or equal to the version of the resources it manages e.g. ASM, RDBMS
- All 11.2 upgrades are out of place

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Grid Infrastructure Upgrade Considerations

- Oracle Home/Base
  - `ORACLE_BASE` for GI should be different than the `ORACLE_BASE` for Oracle Database
  - Each installation user should have its own Oracle Base
  - The 11.2 grid infrastructure home must be owned by the same user as the pre-11.2 clusterware home.
  - `rootupgrade.sh` will change the ownership of the Grid Infrastructure home directory and its parents to `root`

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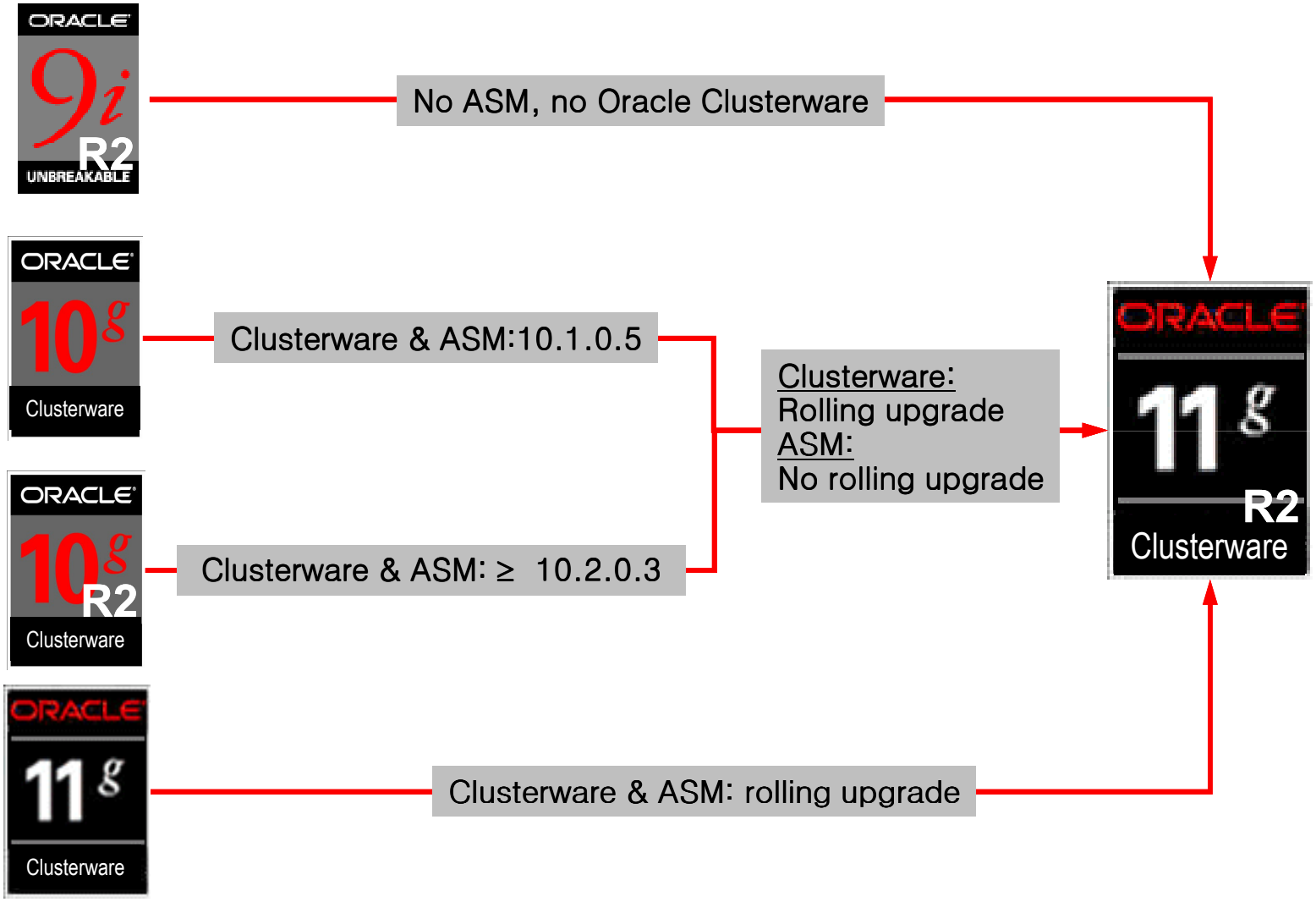
Grid Infrastructure Upgrade Paths



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Grid Infrastructure Upgrade Paths

- Oracle 8*i*/9*i*:
  - There was no Oracle Clusterware, so install GI 11.2
  - There was no ASM therefore no upgrade considerations
- Oracle 10.1
  - Clusterware and ASM support direct upgrade from 10.1.0.5
  - Earlier versions require upgrade to 10.1.0.5 first
  - Clusterware can be rolling upgraded
  - ASM cannot be rolling upgraded

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Grid Infrastructure Upgrade Paths

- Oracle 10.2
  - Clusterware and ASM support direct upgrade from ≥10.2.0.3
  - Earlier versions require upgrade to ≥10.2.0.3 first
  - Clusterware can be rolling upgraded
  - ASM cannot be rolling upgraded
- Oracle 11.1
  - Clusterware and ASM support direct upgrade from ≥11.1.0.6
  - Clusterware can be rolling upgraded
  - ASM can be rolling upgraded from ≥11.1.0.6
    - For ASM 11.1.0.6 only a patch for bug 6872001 is required for an ASM rolling upgrade

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GI Upgrade Planning, Prep and Prereqs

- RAC Starter Kits
  - The goal of the Oracle Real Application Clusters (RAC) Starter Kit is to provide you with the latest information on generic and platform specific best practices for implementing an Oracle RAC cluster
  - MOS Note: 810394.1 - RAC and Oracle Clusterware Starter Kit and Best Practices (Generic)
  - MOS Note: 811306.1 - RAC and Oracle Clusterware Starter Kit and Best Practices (Linux)
  - MOS Note: 811271.1 - RAC and Oracle Clusterware Starter Kit and Best Practices (Windows)
  - MOS Note: 811293.1 - RAC and Oracle Clusterware Starter Kit and Best Practices (AIX)
  - MOS Note: 811303.1 - RAC and Oracle Clusterware Starter Kit and Best Practices (HP-UX)
  - MOS Note: 811280.1 - RAC and Oracle Clusterware Starter Kit and Best Practices (Solaris)
- Plus additional VERY useful notes:
  - MOS Note: 1096952.1 - Master Note for RAC, Clusterware und Grid Infrastructure
  - MOS Note: 1053147.1 - 11.2 Clusterware and Grid Home – What you need to know!

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GI Home: Planning, Prep and Prereqs

- 11.2 Grid Infrastructure Home cannot reside on a shared cluster file system e.g. ocfs2, Veritas CFS
  - NFS based shared storage is supported
  - Installer will allow move from 10.2 on CFS to 11.2 on non-CFS
- All cluster nodes must be up and running
  - Remove any down nodes, or start them if possible
- Unset environment variables `ORACLE_HOME`, `ORACLE_BASE` and `ORA_CRS_HOME` for the installing user - the install scripts handle these
- Avoid OUI `AttachHome` issues
  - Set the following parameter in the SSH daemon configuration file `/etc/ssh/sshd_config` on all cluster nodes before running OUI
    - `LoginGraceTime 0`
  - Restart `sshd`
- Provision network resources for Single Client Access Name (SCAN)

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SCAN: Planning, Prep and Prereqs

- Oracle Database 11.2 Clients connect to the database using SCAN VIPs
- The SCAN is associated with the entire cluster rather than an individual node
- Resolves to up to 3 IP Addresses in DNS or GNS
  - IP addresses returned in a round-robin manner
- SCAN listeners run under the Grid Infrastructure Home
- Provides load balancing and failover for client connections
- Check this white paper for more details:
  - Oracle Real Application Clusters 11*g* Release 2 Overview of SCAN (PDF)
    http://www.oracle.com/technetwork/database/clustering/overview/scan-129069.pdf

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SCAN: Planning, Prep and Prereqs

- SCAN VIPs - Network Requirement
  - A single client access name (SCAN) configured in DNS

```
[root@cluster1 oracle]# nslookup

mycluster-scan1
Server:         120.20.190.70
Address:        120.20.190.70#53
Name: mycluster -scan1.mydomain.com
Address: 10.148.46. 79
Name: mycluster -scan1.mydomain.com
Address: 10.148.46. 77
Name: mycluster -scan1.mydomain.com
Address: 10.148.46. 78
```

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Completing the Upgrade

- Top Level Flow:
  - Verify the hardware/software environment
  - Install the software
  - Configure the software
  - Finalize the upgrade

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Completing the Upgrade

- Top Level Flow:
  - Verify the hardware/software environment
    - Secure Shell
      - We recommend using OUI to set up `ssh`
        - Old ssh setup not always considered valid by 11.2 OUI, due to tighter restrictions, but OUI will correct it
      - OUI will validate `ssh` before allowing you to continue
        - Watch out for `stty` commands or profile messages that may cause the automatic setup of `ssh` to fail
    - Cluster Verification Utility
      - Integrated into OUI but recommended to run before an install/upgrade
      - Has “fixup scripts” to correct certain failures (e.g. kernel parameters)
      - The most recent version is available from OTN
        - http://www.oracle.com/technology/products/database/clustering/cvu/cvu_download_homepage.html
  - Install the software
  - Configure the software
  - Finalize the upgrade

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Completing the Upgrade

- Top Level Flow:
  - Verify the hardware/software environment
  - Install the software
    - Oracle Universal Installer – `./runInstaller`
      - Should find existing Oracle Clusterware and suggest upgrade to Grid Infrastructure
      - Must run installer as the previous version's software owner
      - If you need to collect debug tracing (request from support)
        - `./runInstaller -debug`
        - Output is written to `stdout` by default
        - Use `script` command to capture the output
    - Following screenshots are from an 10.2.0.4 upgrade
  - Configure the software
  - Finalize the upgrade

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Grid Infrastructure Upgrade 11.2

- Additional information: Pinning nodes [from documentation]

In order to change the node pin behavior the appropriate command is the */crsctl pin/unpin css/* command, to pin or unpin any specific node. Pinning a node means that the association of a node name with a node number is fixed. If a node is not pinned, its node number may change if the lease expires while it is down. The lease of a pinned node never expires. Deleting a node with the */crsctl delete node/* command implicitly unpins the node.

– During upgrade of Oracle Clusterware, all servers are pinned, whereas after a fresh installation of Oracle Clusterware 11/g /release 2 (11.2), all servers you add to the cluster are unpinned.

– You cannot unpin a server that has an instance of Oracle RAC that is older than Oracle Clusterware 11/g/ release 2 (11.2) if you installed Oracle Clusterware 11/g/ release 2 (11.2) on that server.

Pinning a node is required for rolling upgrade to Oracle Clusterware 11.2 and will be done automatically. We have seen cases where customer perform a manual upgrade and this would fail due to unpinned nodes.

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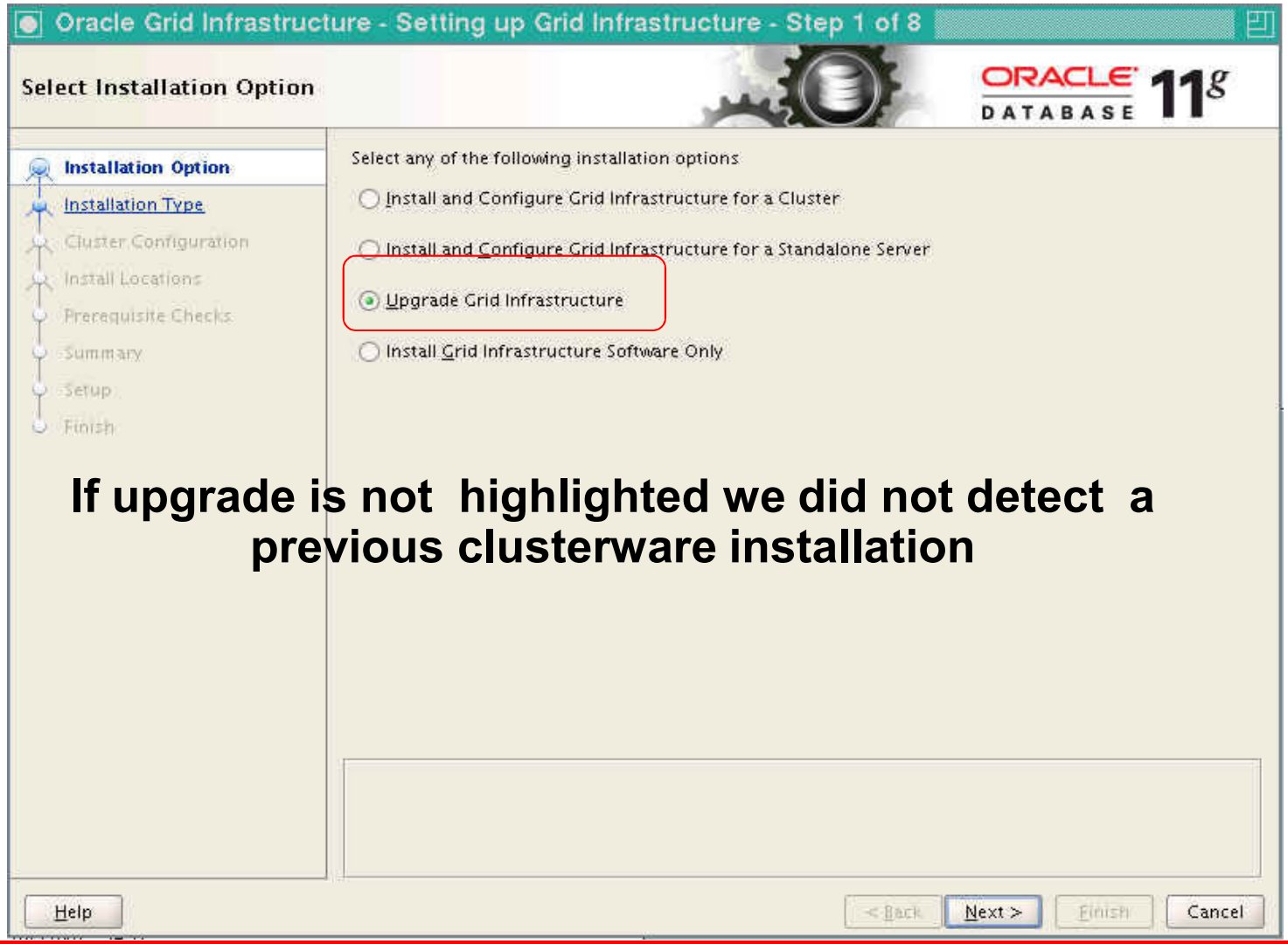
Grid Infrastructure Upgrade 11g Release 2



If upgrade is not highlighted we did not detect a previous clusterware installation

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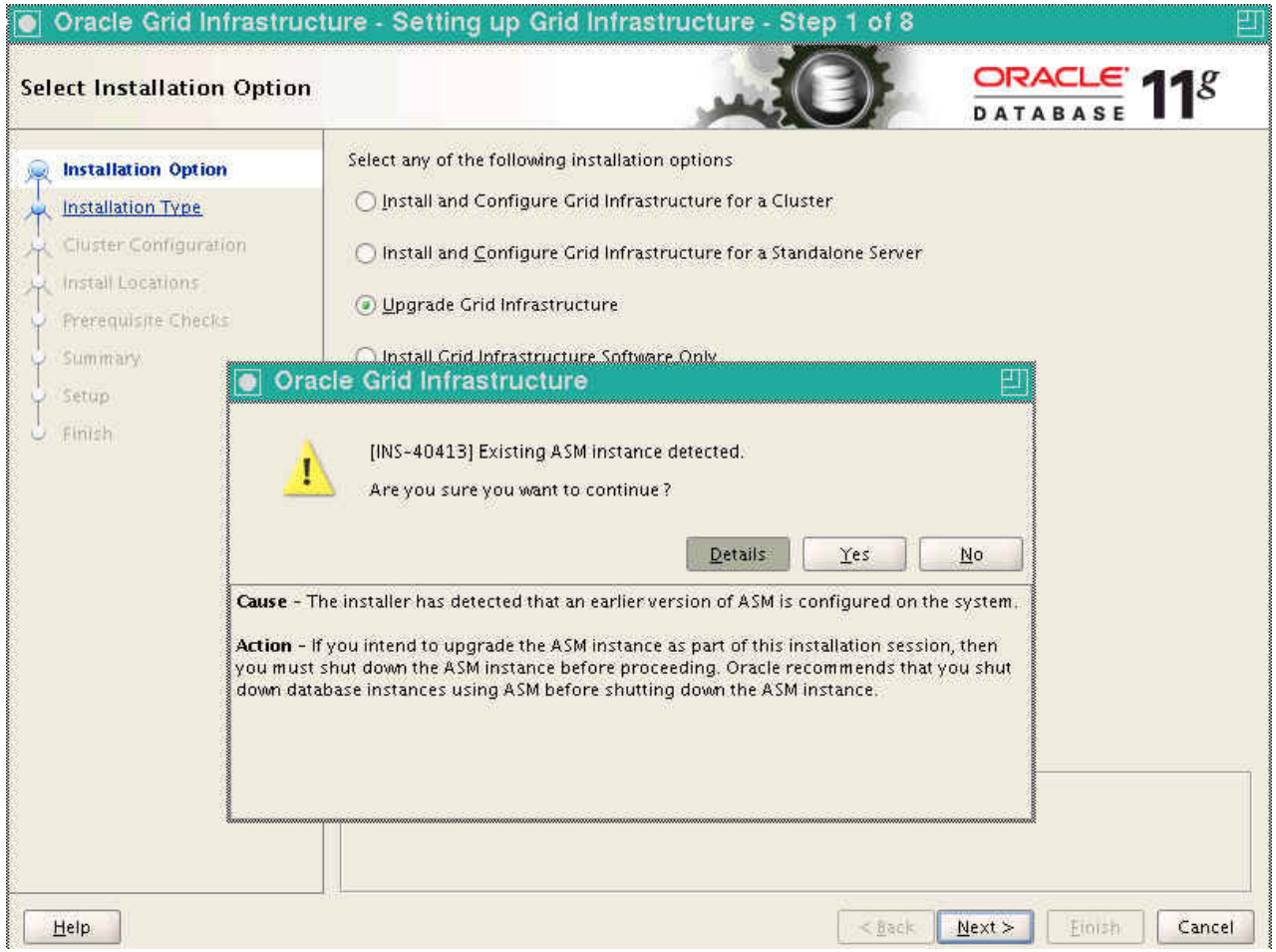
Grid Infrastructure Upgrade 11g Release 2



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Grid Infrastructure Upgrade 11*g* Release 2

- OUI detects existing ASM instances and responds:
  - `INS-40413 Existing ASM Instance Detected`
    - Tells you that if you intend to upgrade ASM, you must shut down all ASM instances and therefore all database instances
  - What does this mean to you ?
    - Once you understand there will be a complete outage when `asmca` is running, then hit **`YES`**
    - ASM and database should remain up
    - `rootupgrade.sh` will shutdown as required (rolling)
    - `asmca` will shutdown instances as required
      - Upgrade from 11.1: In rolling fashion
      - Upgrade from 10g: Non-rolling (complete outage)

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Grid Infrastructure Upgrade 11g Release 2

GRID_HOME

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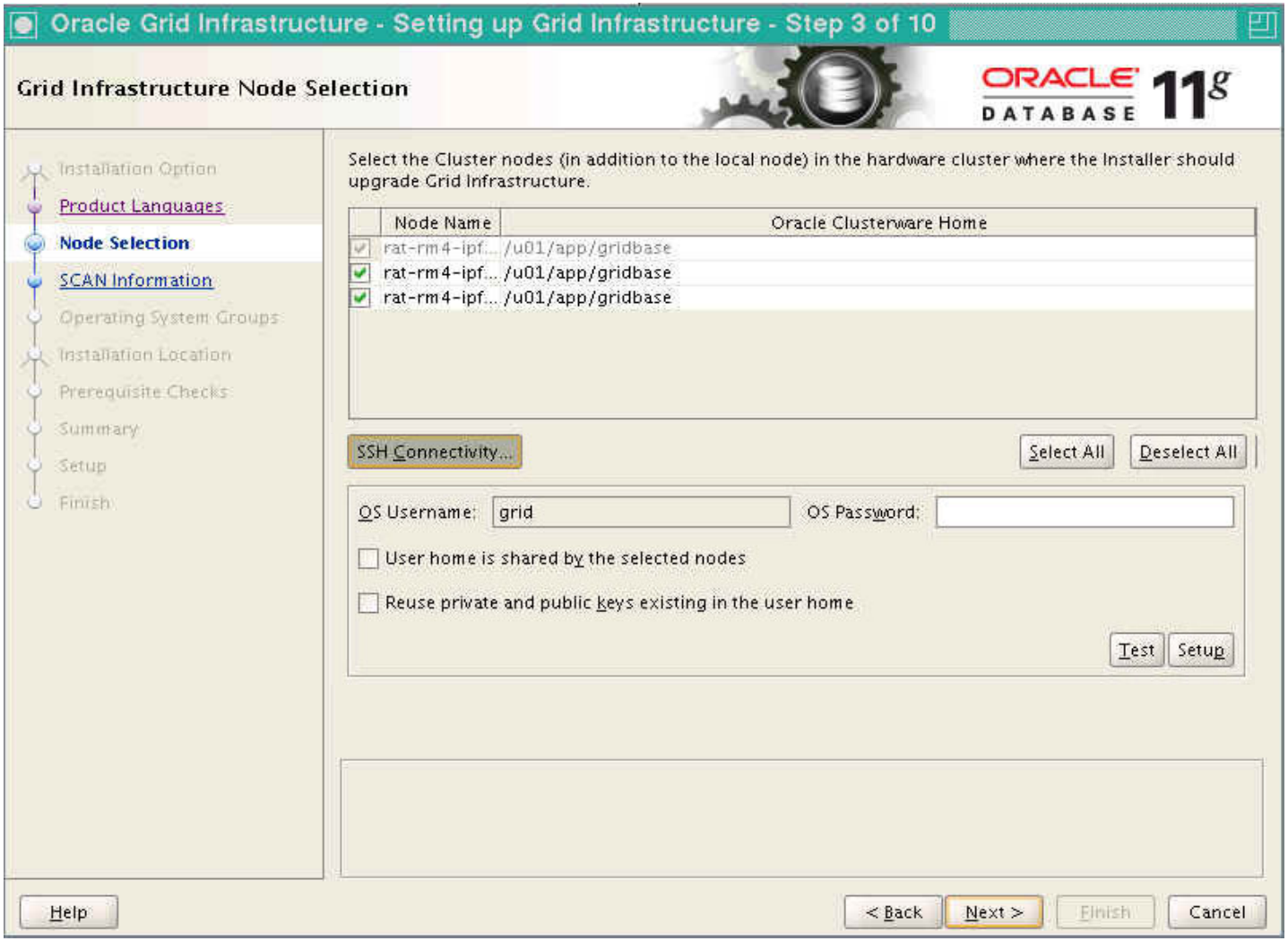
Grid Infrastructure Upgrade 11g Release 2

Node Selection and SSH



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Grid Infrastructure Upgrade 11g Release 2

Setup ASM Roles

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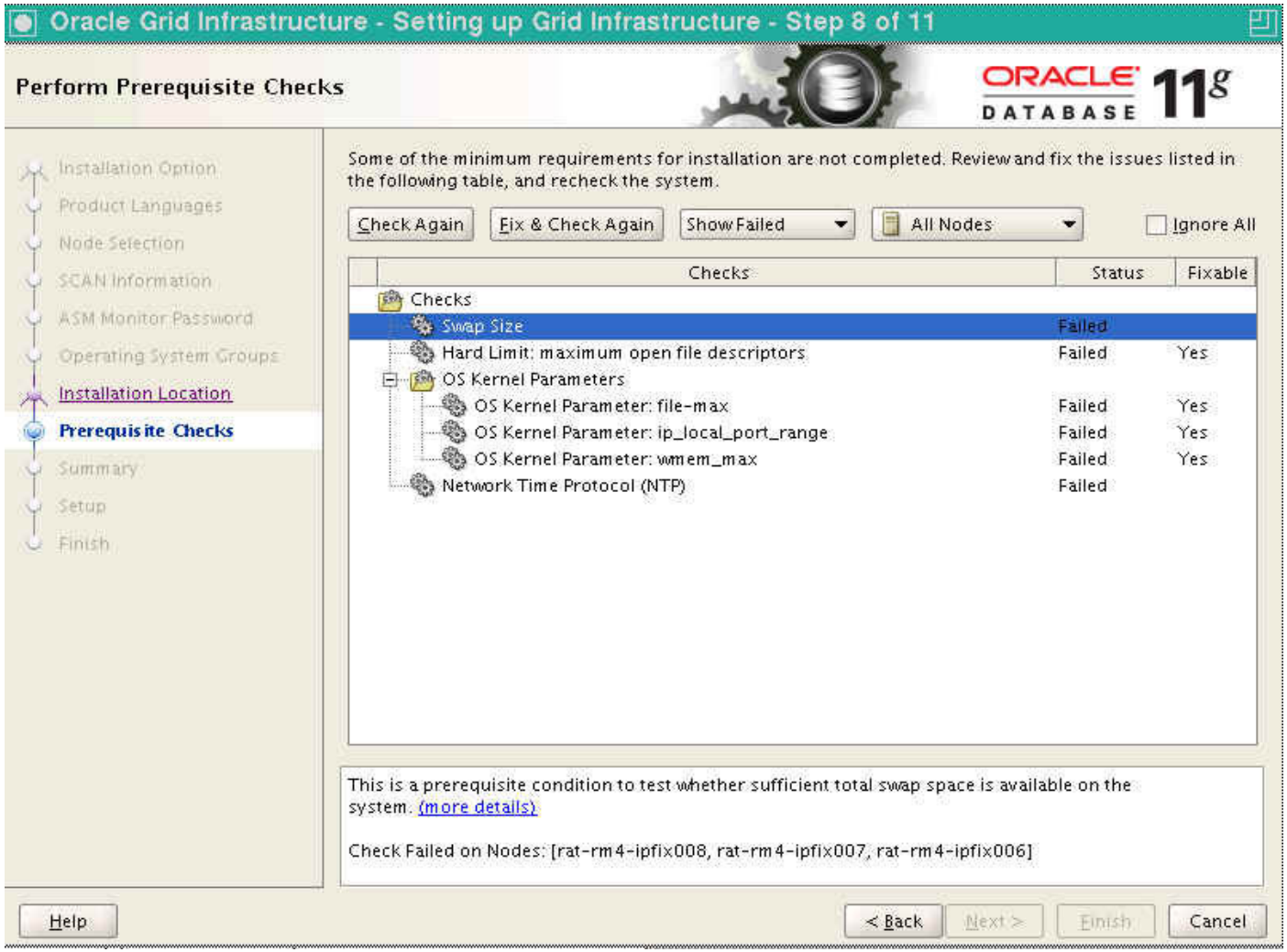
Oracle Clusterware Upgrade 11*g* Release 2

Cluster Verification



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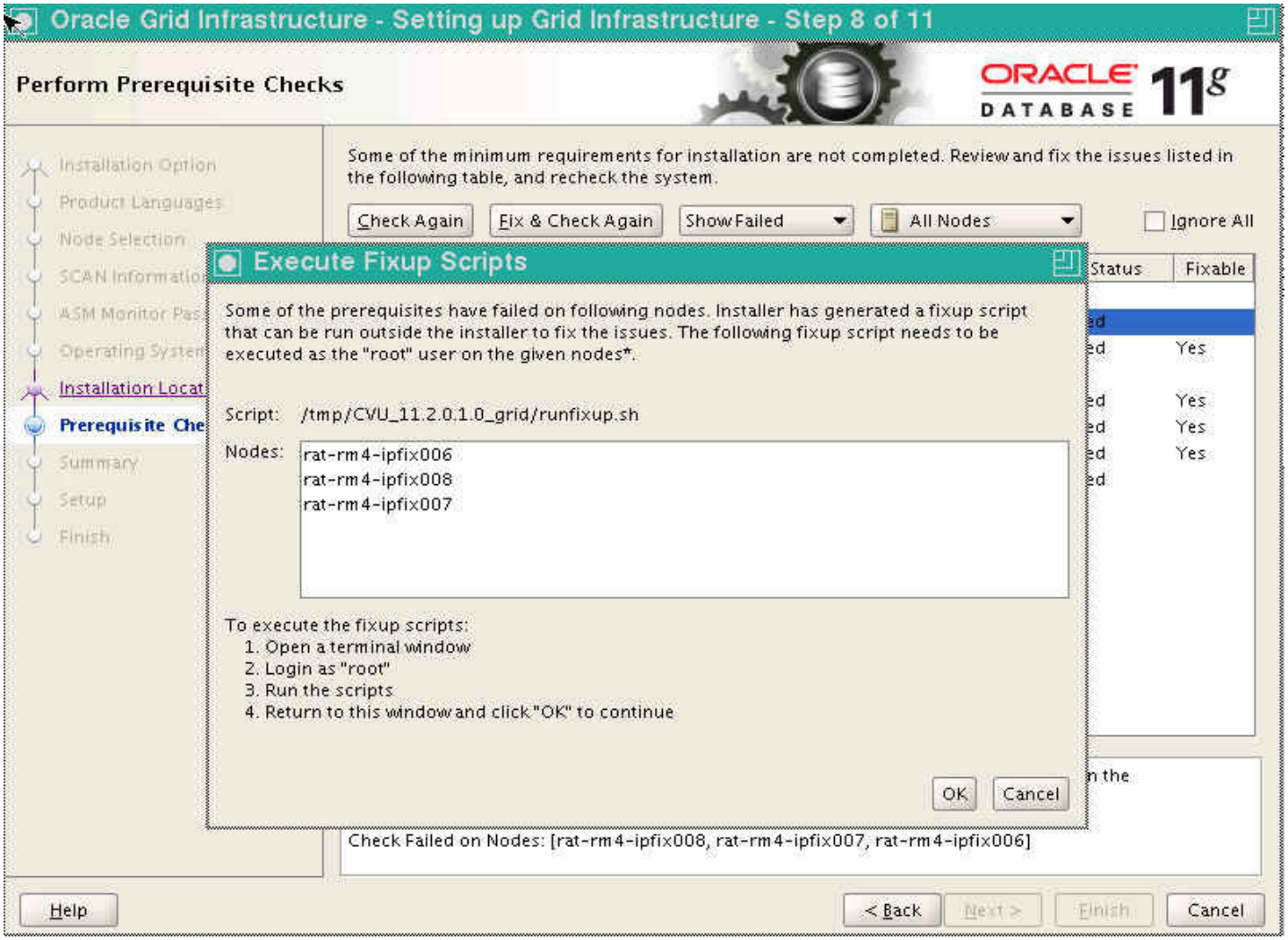
Grid Infrastructure Upgrade 11g Release 2

Cluster Verification



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Grid Infrastructure Upgrade 11*g* Release 2

Cluster Verification

```
root> /tmp/CVU_11.2.0.1.0_grid/runfixup.sh

Response file being used is :/tmp/CVU_11.2.0.1.0_grid/fixup.response
Enable file being used is :/tmp/CVU_11.2.0.1.0_grid/fixup.enable
Log file location: /tmp/CVU_11.2.0.1.0_grid/orarun.log
Setting Kernel Parameters...
fs.file-max = 327679
fs.file-max = 6815744
net.ipv4.ip_local_port_range = 9000 65500
net.core.wmem_max = 262144
net.core.wmem_max = 1048576
uid=501(grid)gid=502(oinstall)groups=502(oinstall),
        503(asmadmin),504(asmdba)
```

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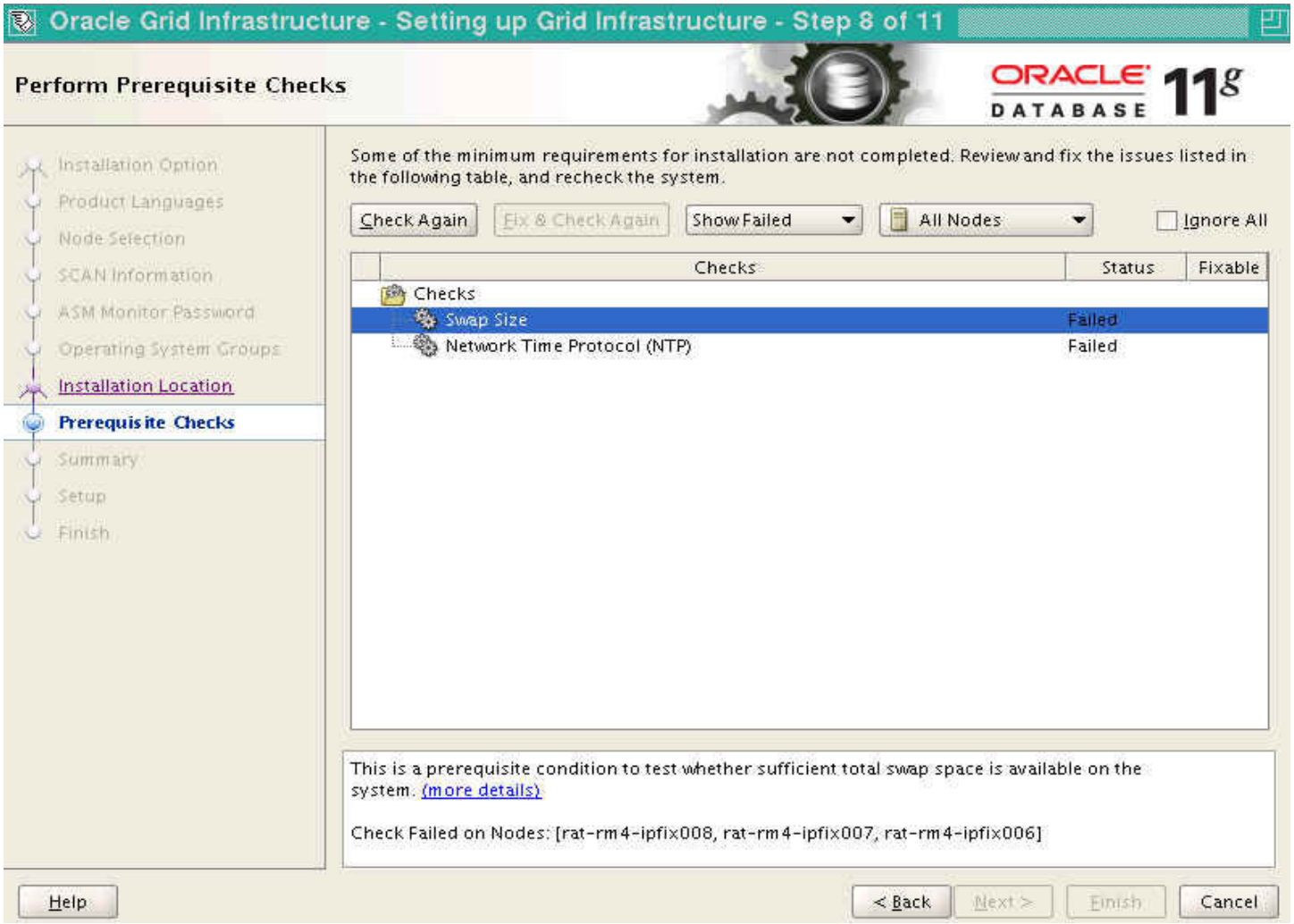
Grid Infrastructure Upgrade 11g Release 2

Cluster Verification



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Clusterware - ASM - DB Compatibility

Note: 337737.1

Clusterware	ASM	DB
11.2	11.2(a)	11.2
11.2	11.2(a)	11.1
11.2	11.2(a)	10.2
11.1	11.1	11.1(b)
11.1	11.1	10.2
11.1	11.1	10.1
11.1	10.2	11.1
11.1	10.2	10.2
11.1	10.2	10.1
11.1	10.1(c)	11.1
11.1	10.1(c)	10.2
11.1	10.1	10.1
10.2	10.2	10.2
10.2	10.2	10.1
10.2	10.1(c)	10.2
10.2	10.1	10.1
10.1	10.1	10.1

a) The Matrix is valid after the (rolling) upgrade has been completed. During the upgrade you may use an older ASM version.
b) The ASM version needs to be at least 10.1.0.3

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Oracle Grid Infrastructure Patching

- Oracle Grid Infrastructure Patch Set 11.2.0.2:
  - Patch set is not the correct wording: it's a full release
  - Installation is out-of-place only into a separate home

  - To upgrade from GI 11.2.0.1 to GI 11.2.0.2:
    - Apply PSU 11.2.0.1.2 (or newer) in-place
    - Follow all instructions in Note:1212703.1
      - Make sure MULTICAST is setup correctly Note:1054902.1 – section D
      - Make sure to check Oracle Database Readme 11g Release 2 Section 2.39 - "Open Bugs"
    - Then upgrade GI within OUI

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Oracle EXADATA 11.2.0.2 Patching

- For patching 11.2.0.1 to 11.2.0.2 follow all instructions in Note:1279458.1
  Exadata Database Machine Reference Guide for Upgrade 11.2.0.1 to 11.2.0.2
  - MULTICAST is already setup correctly on a Database Machine V2

- For certification, recommendations, issues, current patches etc. see Note:888828.1
  Database Machine and Exadata Storage Server 11.2 Supported Versions

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Oracle Clusterware & ASM Upgrade

- Documentation:
  - Oracle Clusterware Administration and Deployment Guide 11*g*
    http://download.oracle.com/docs/cd/E11882_01/rac.112/e16794/toc.htm
- Grid Infrastructure Upgrade Known Issues:
  - Note: 948456.1
    Pre 11.2 Database Issues in 11gR2 Grid Infrastructure
- Oracle Clusterware rolling upgrade:
  - Note: 338706.1: Oracle Clusterware Rolling Upgrades
- RAC Best Practices Starter Kit:
  - Note:810394.1
- Upgrading an ASM instance with OUI within Oracle Clusterware upgrade: OUI or `asmca -upgrade`
  - http://download.oracle.com/docs/cd/E11882_01/server.112/e16102/asmca.htm#sthref586

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Oracle Grid Infrastructure Downgrade

- From the documentation:

  http://download.oracle.com/docs/cd/E11882_01/server.112/e17222/downgrade.htm#UPGRD52664

- Downgrading the Oracle Clusterware Configuration

  You can downgrade the Oracle Clusterware configuration to the state it was in before the Oracle Clusterware 11g release 2 (11.2) upgrade. This is essentially a restoration of the earlier release. Any configuration changes you have performed during or after the 11g release 2 (11.2) upgrade are removed and cannot be recovered.

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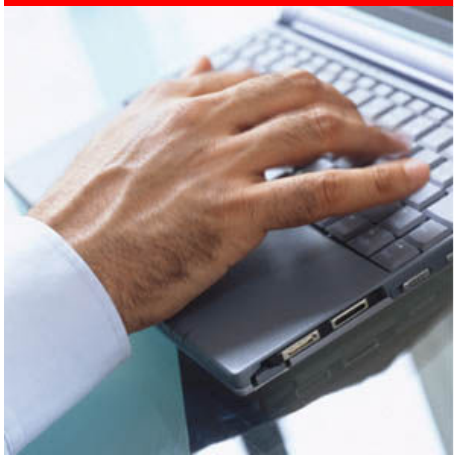

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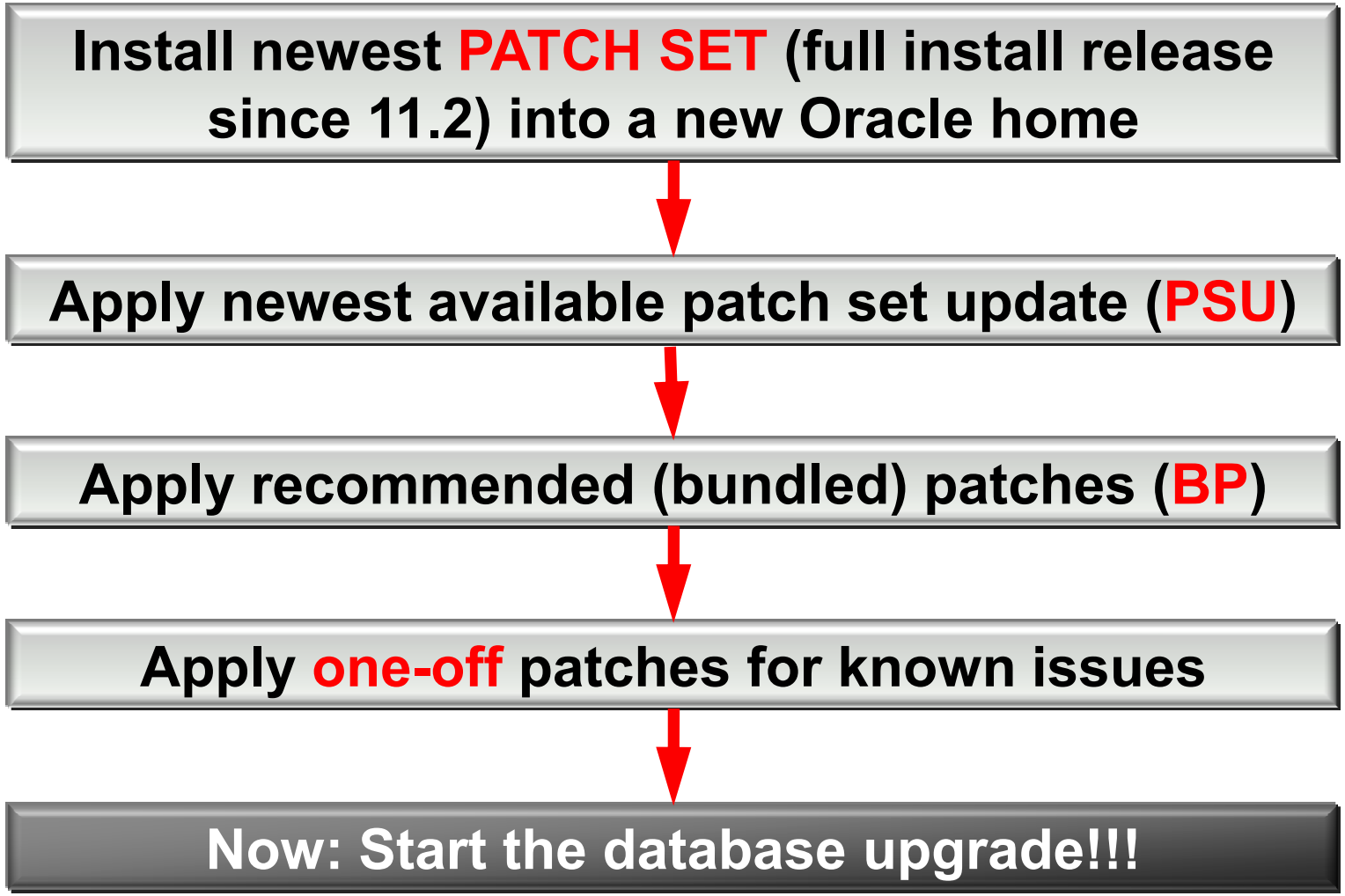
Installation Database Home 11.2



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Installation - Loopback Adapter for DBcontrol

- Microsoft Loopback Adapter is recommended if IP address is distributed via DHCP
  - Install the MS Loopback Adapter
    - Launch the *Add Hardware* wizard and install a new network adapter - manufacturer is *Microsoft*
  - Adjust this adapter to be the primary network adapter
    - *My Network Places* => *Properties* => *TCP/IP*
      - `IP address: 10.10.10.10`
      - `Subnet mask: 255.255.255.0`
  - Edit:
    - **\windows\system32\drivers\etc\hosts**
      - `10.10.10.10 mycomputer.mydomain.com mycomputer`

- `http://download.oracle.com/docs/cd/B28359_01/install.111/b32006/reqs.htm#sthref291`

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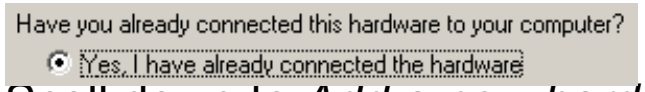
Installation - Loopback Adapter for DBcontrol

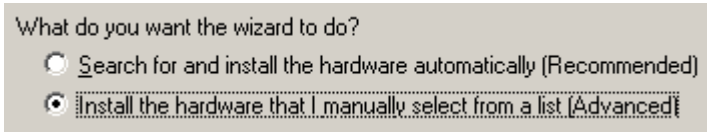
- Launch the Windows *Add Hardware* Wizard

- Choose *Yes, I've already connected the hardware ...*

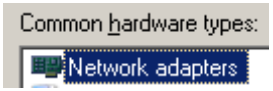


- Scoll down to *Add a new hardware device*

- Choose *Install the hardware that I manually select ...*



- Select *Network Adapters:*



- Click on Manufacturer *Microsoft*
- Install the *Loopback Adapter*

- Make the Loopback Adapter the FIRST network card in TCP/IP properties!!

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Installation

- Space / resource requirements
  - RAM: ≥ 1GB
  - Software installation:
    - 1GB in /tmp or \TEMP necessary
    - Between 3 GB (Windows), 3.9 GB (Linux32) and 7 GB (HP-UX)
  - *Seed* database: ≥ 1.7 GB
    - Seed databases (ORCL) are always prebuilt EE databases with all options!!!
  - Swapspace
    - Between 1 GB and 2 GB: 1.5 times the size of RAM
    - Between 2 GB and 16 GB: Equal to the size of RAM
    - More than 16 GB: 16 GB

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Installation 11*g* Release 2

- Note.884232.1 11.2 Changes with all new 11.2 OUI

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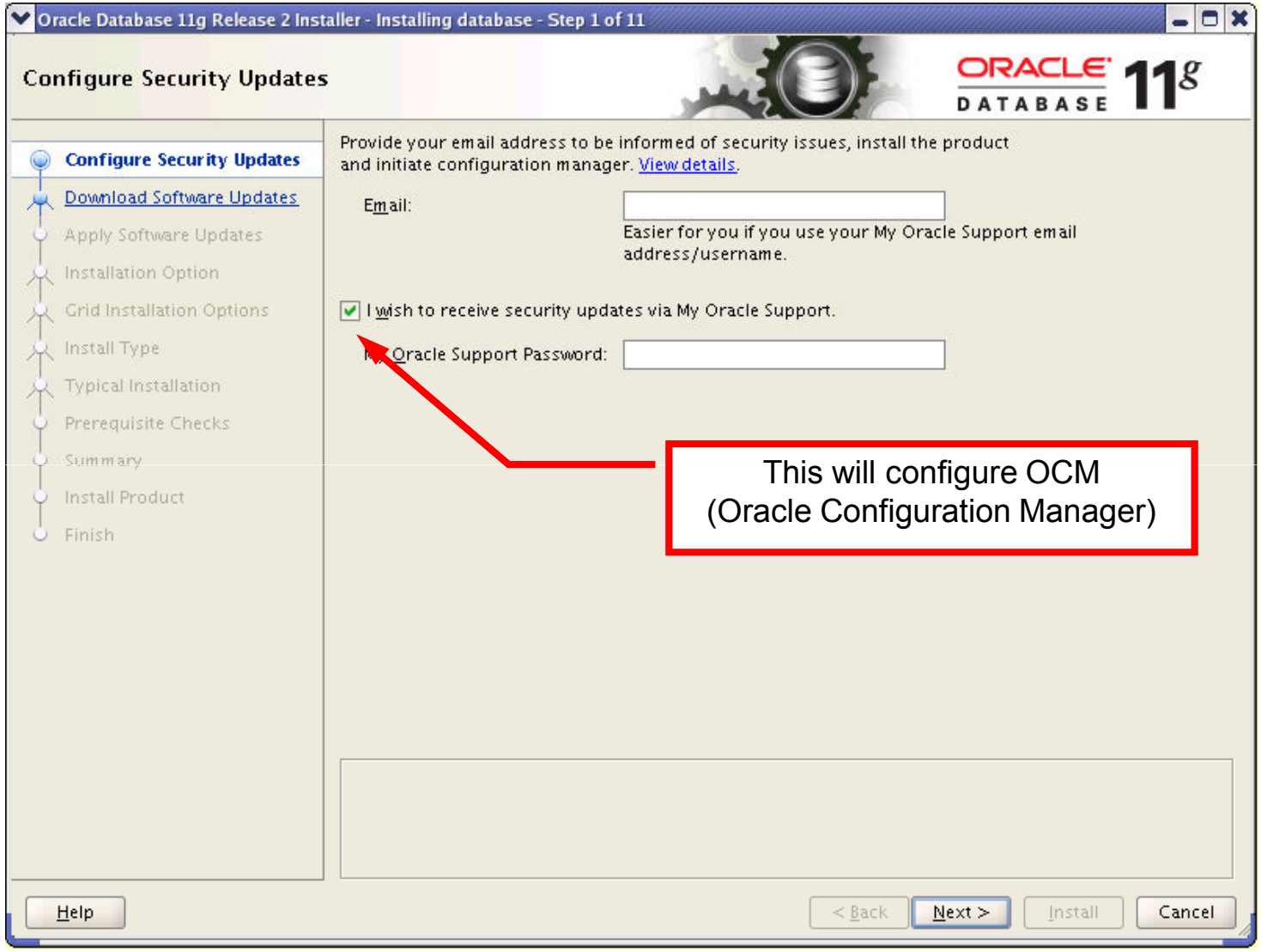
Installation 11*g* Release 2



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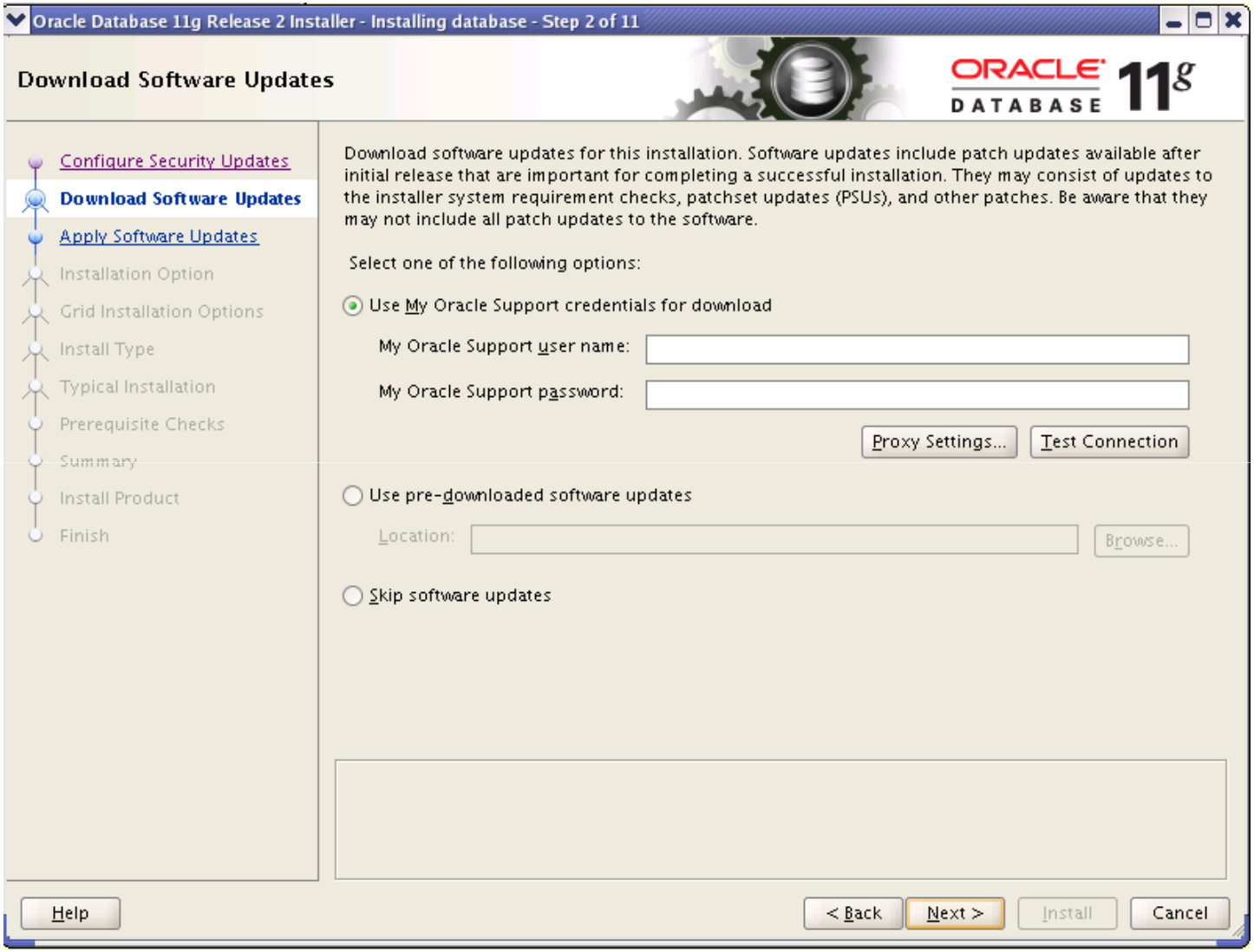
Installation 11*g* Release 2



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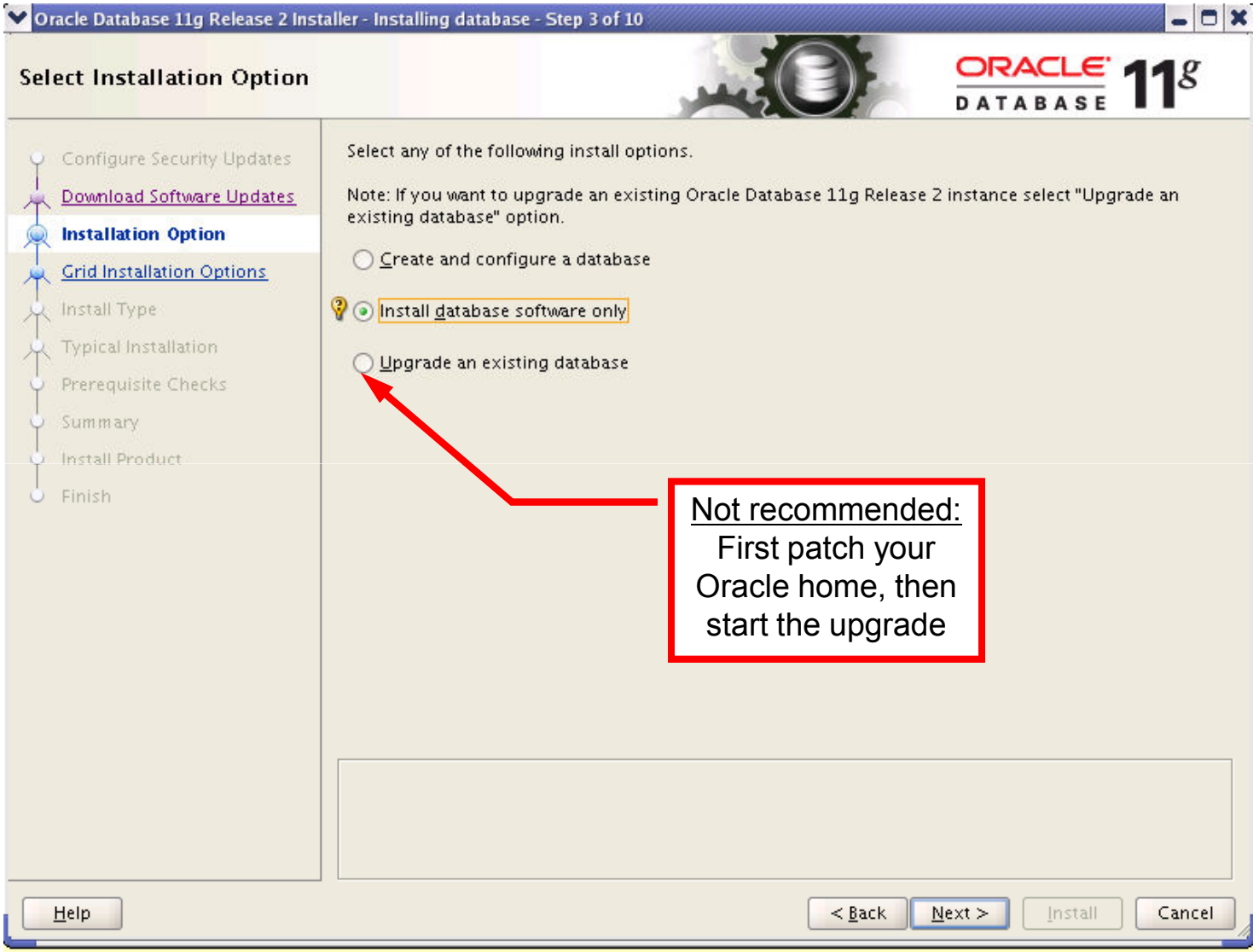
Installation 11*g* Release 2



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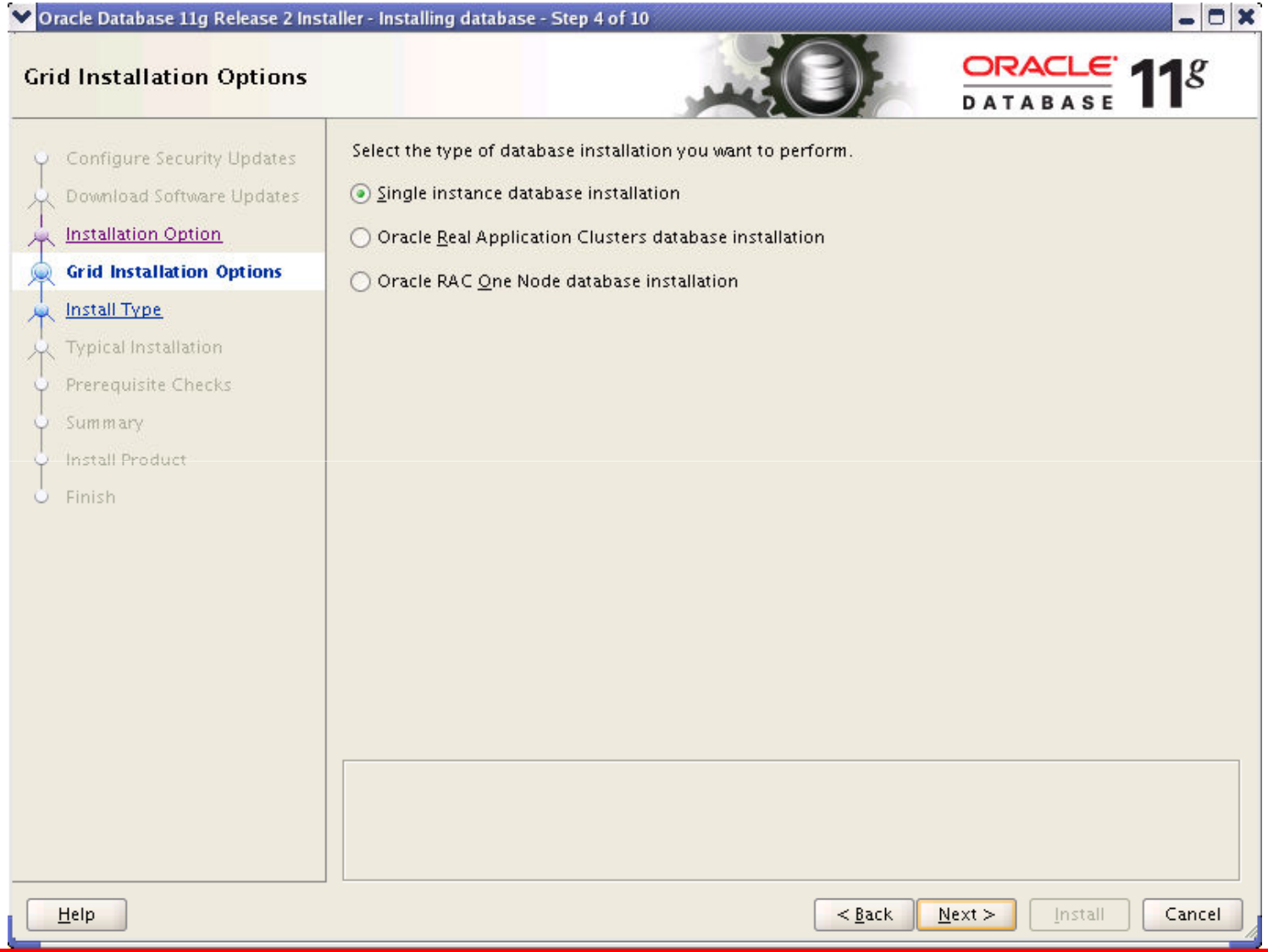
Installation 11*g* Release 2



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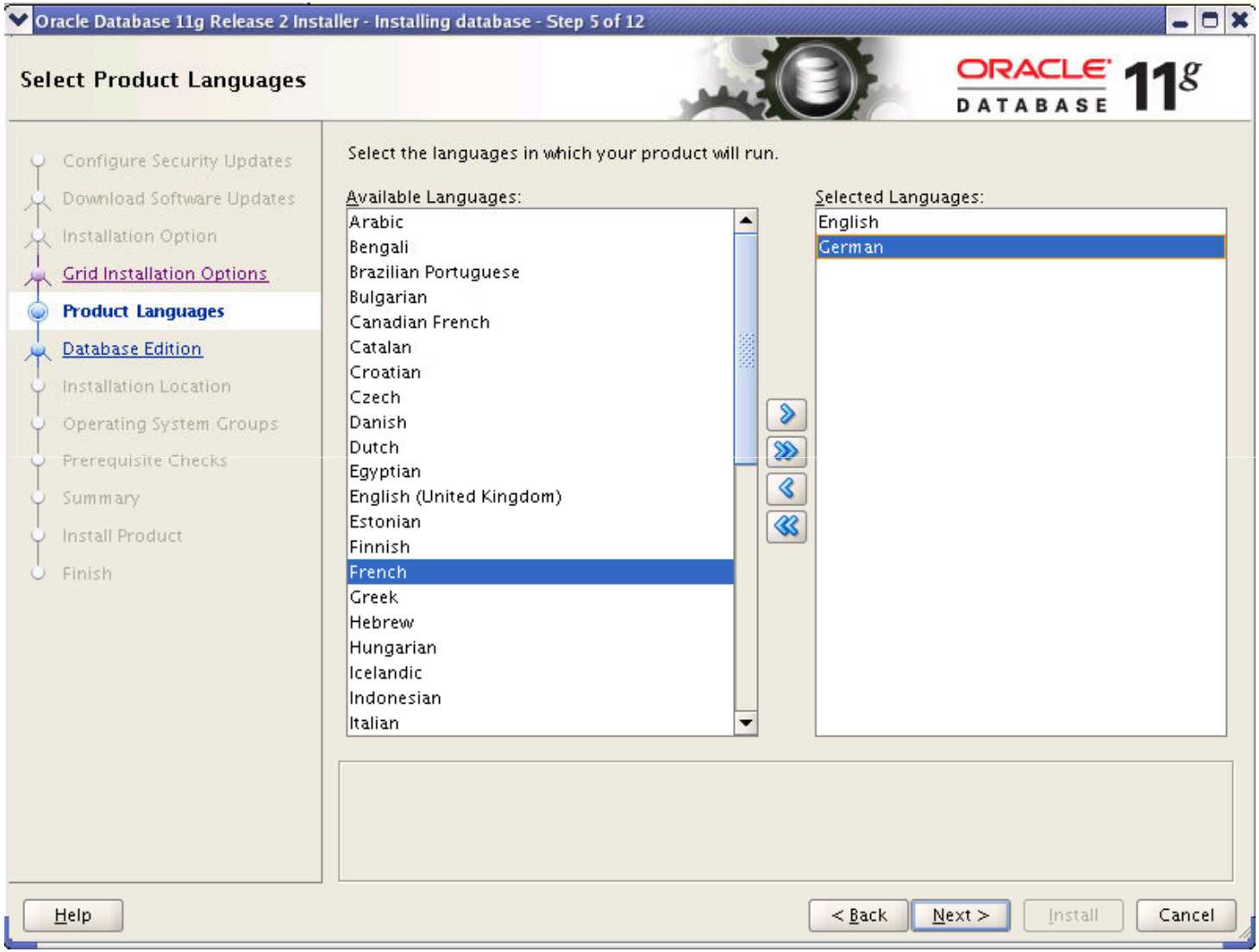
Installation 11*g* Release 2



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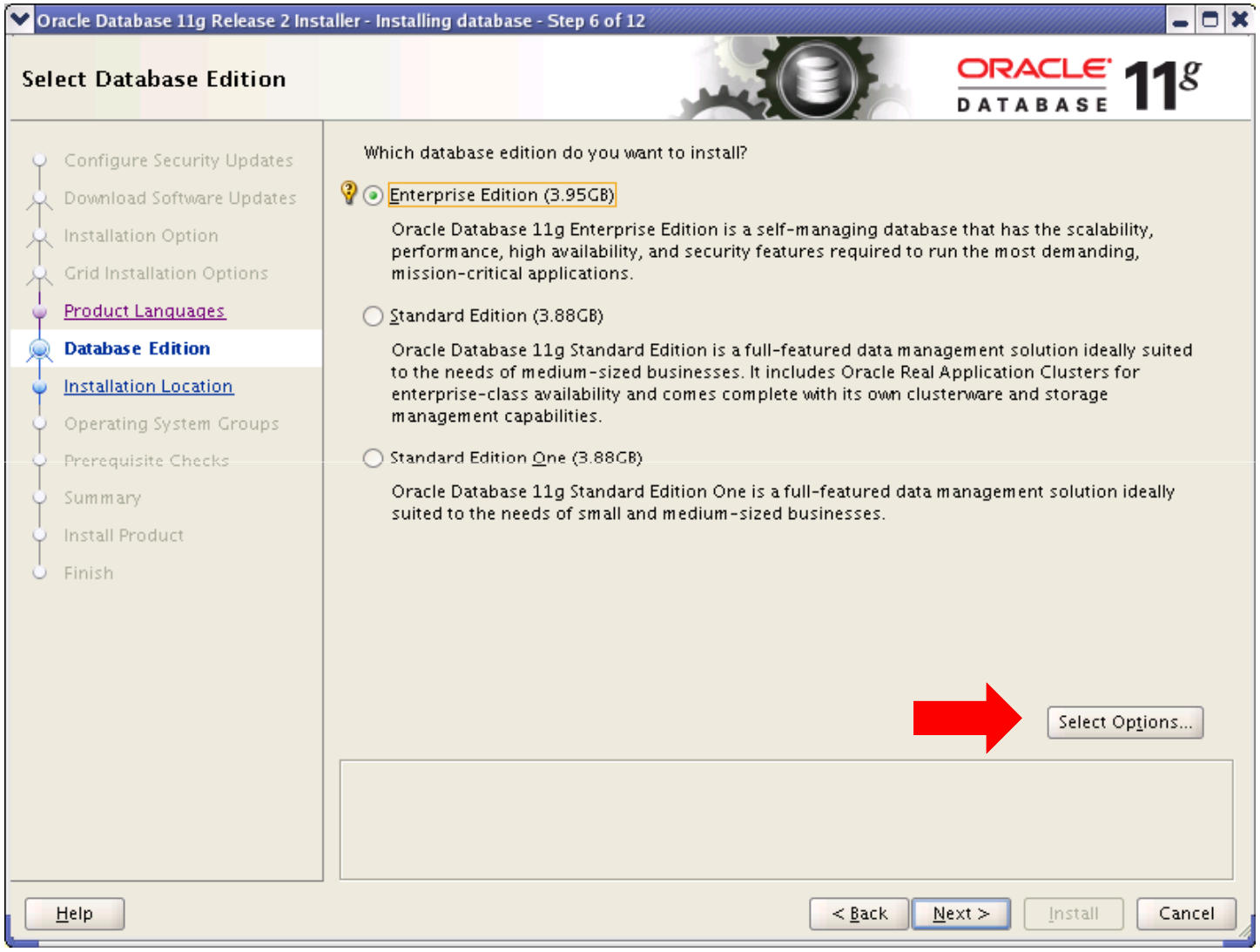
Installation 11*g* Release 2



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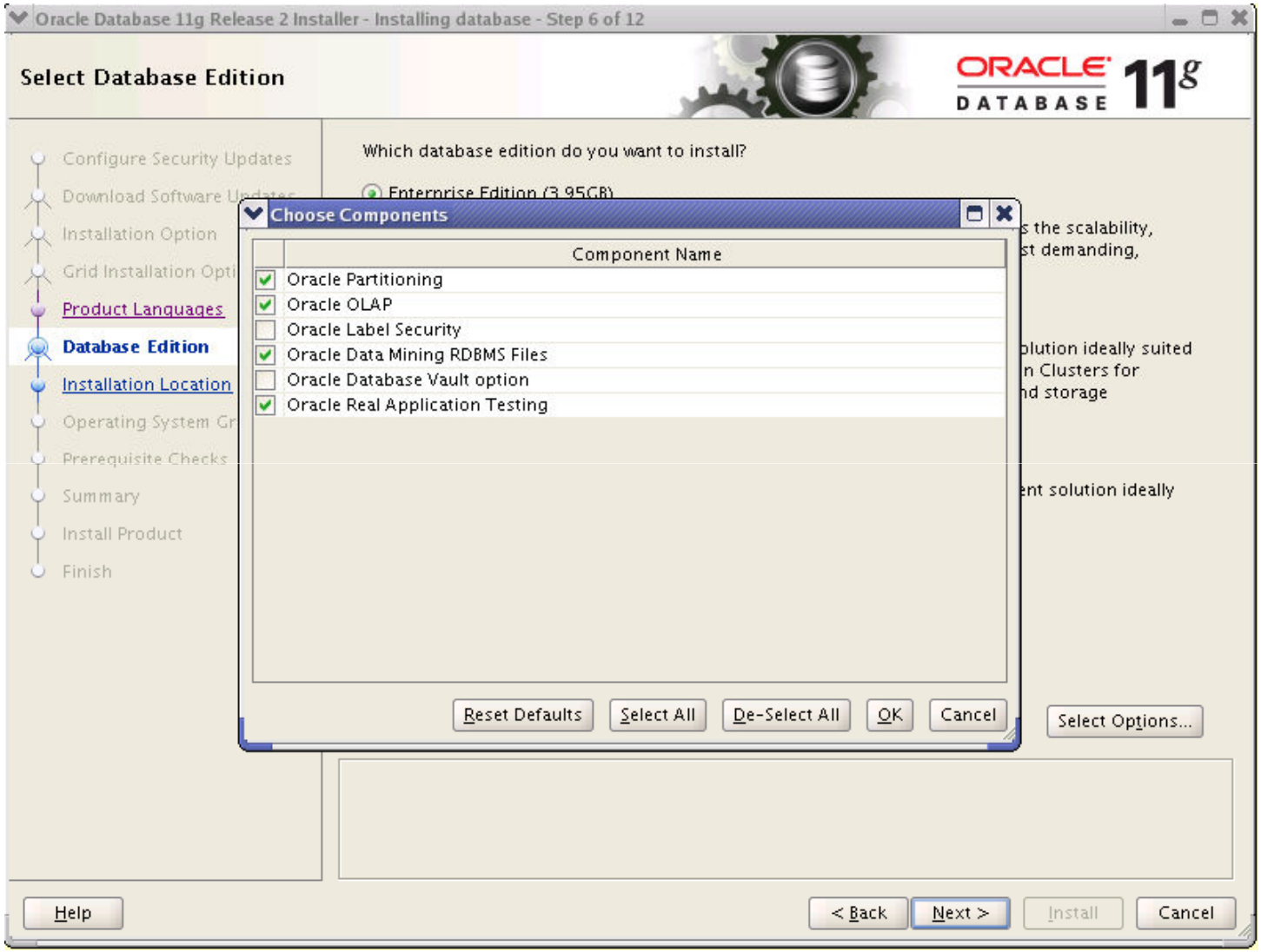
Installation 11*g* Release 2



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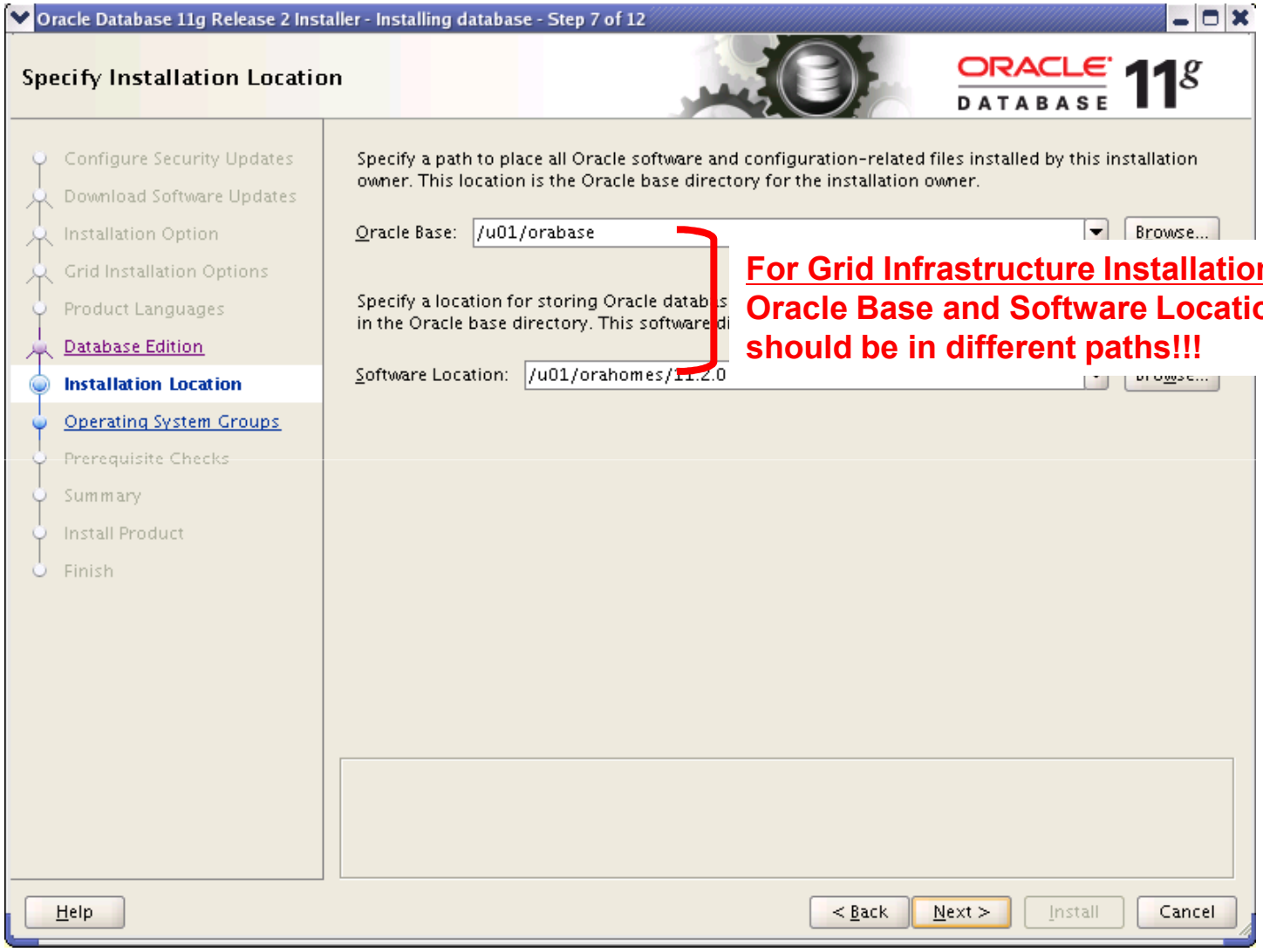
Installation 11*g* Release 2



For Grid Infrastructure Installations: Oracle Base and Software Location should be in different paths!!!

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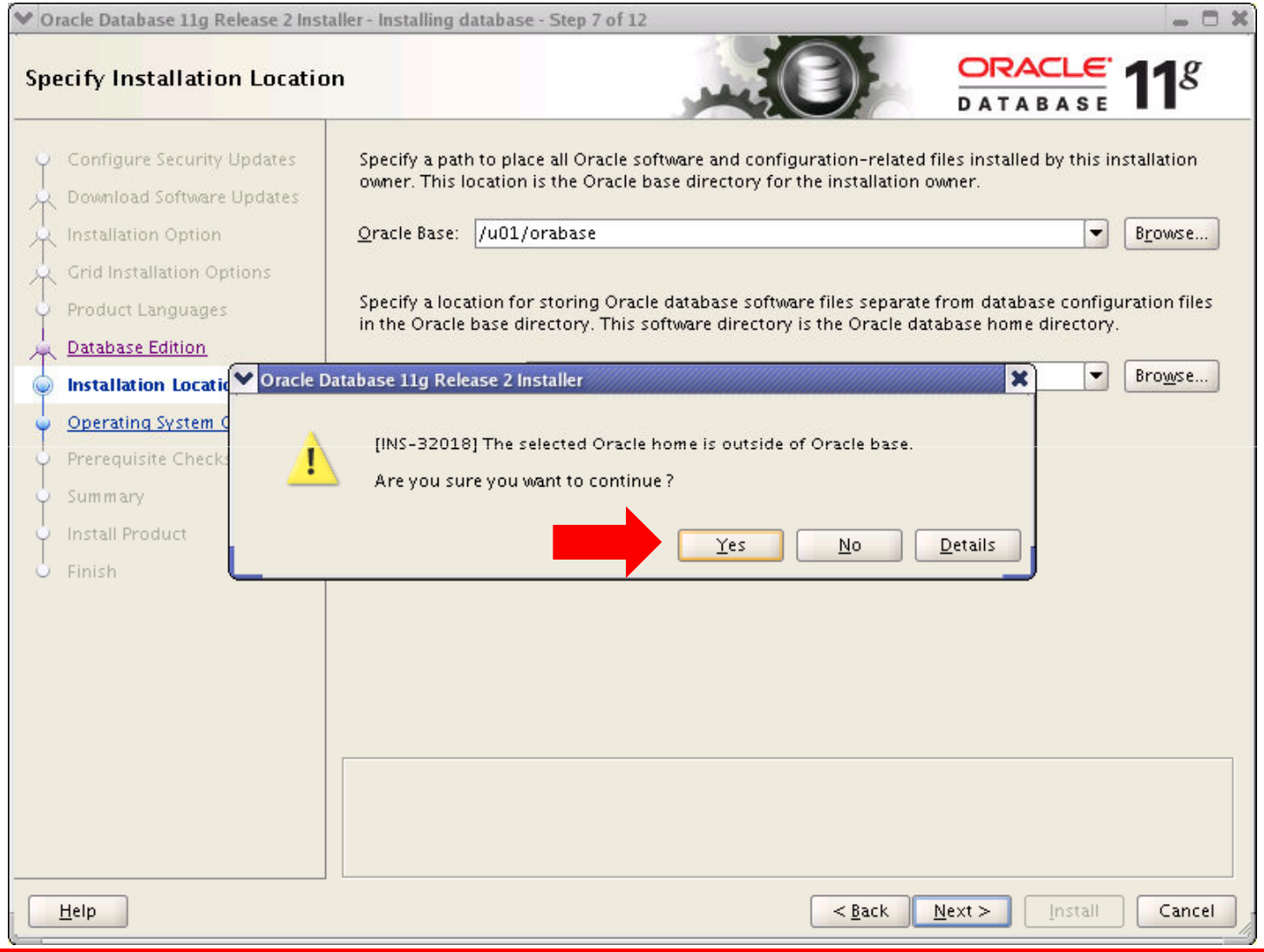
Installation 11*g* Release 2



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Installation 11*g* Release 2

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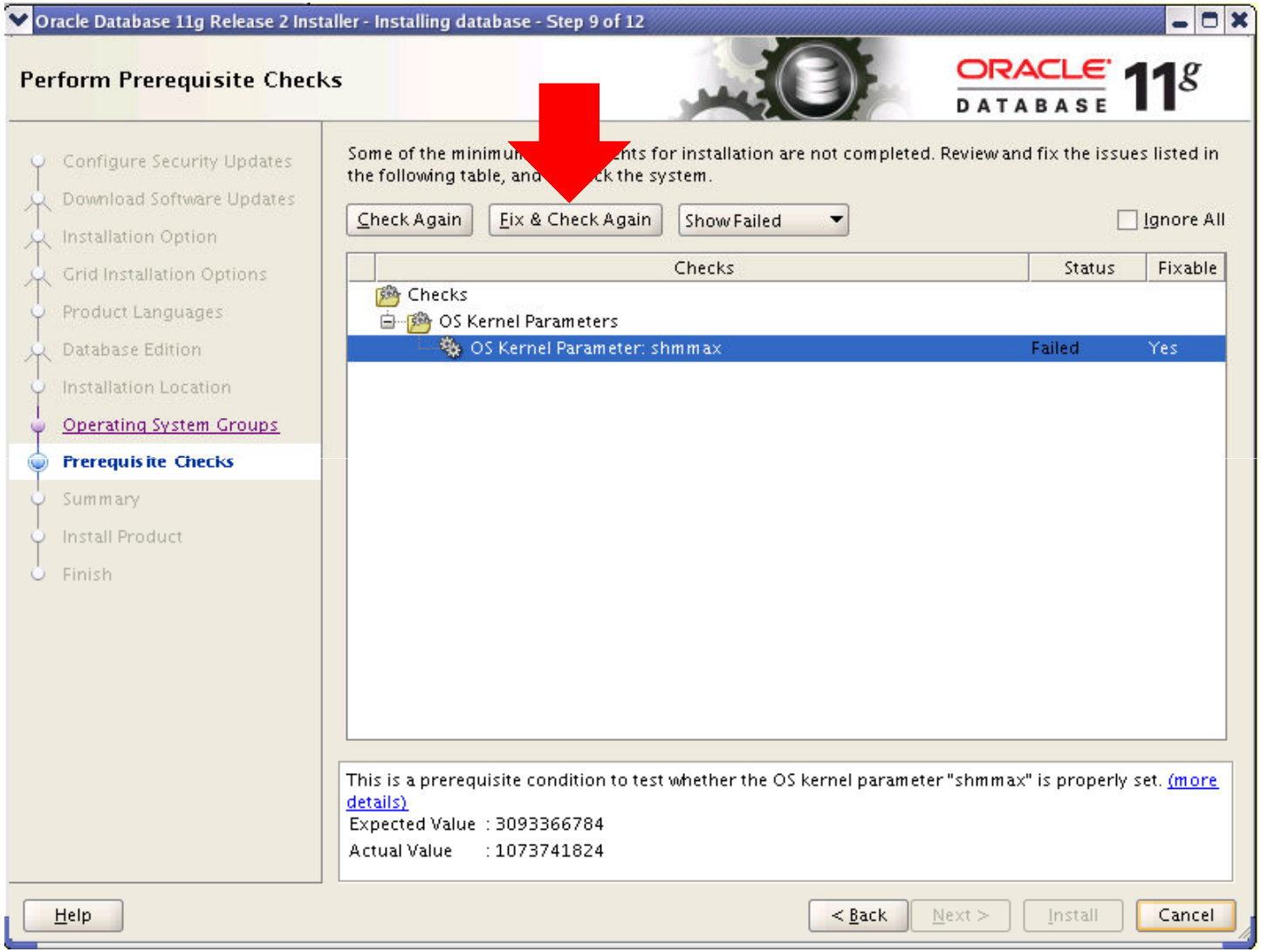
Installation 11*g* Release 2



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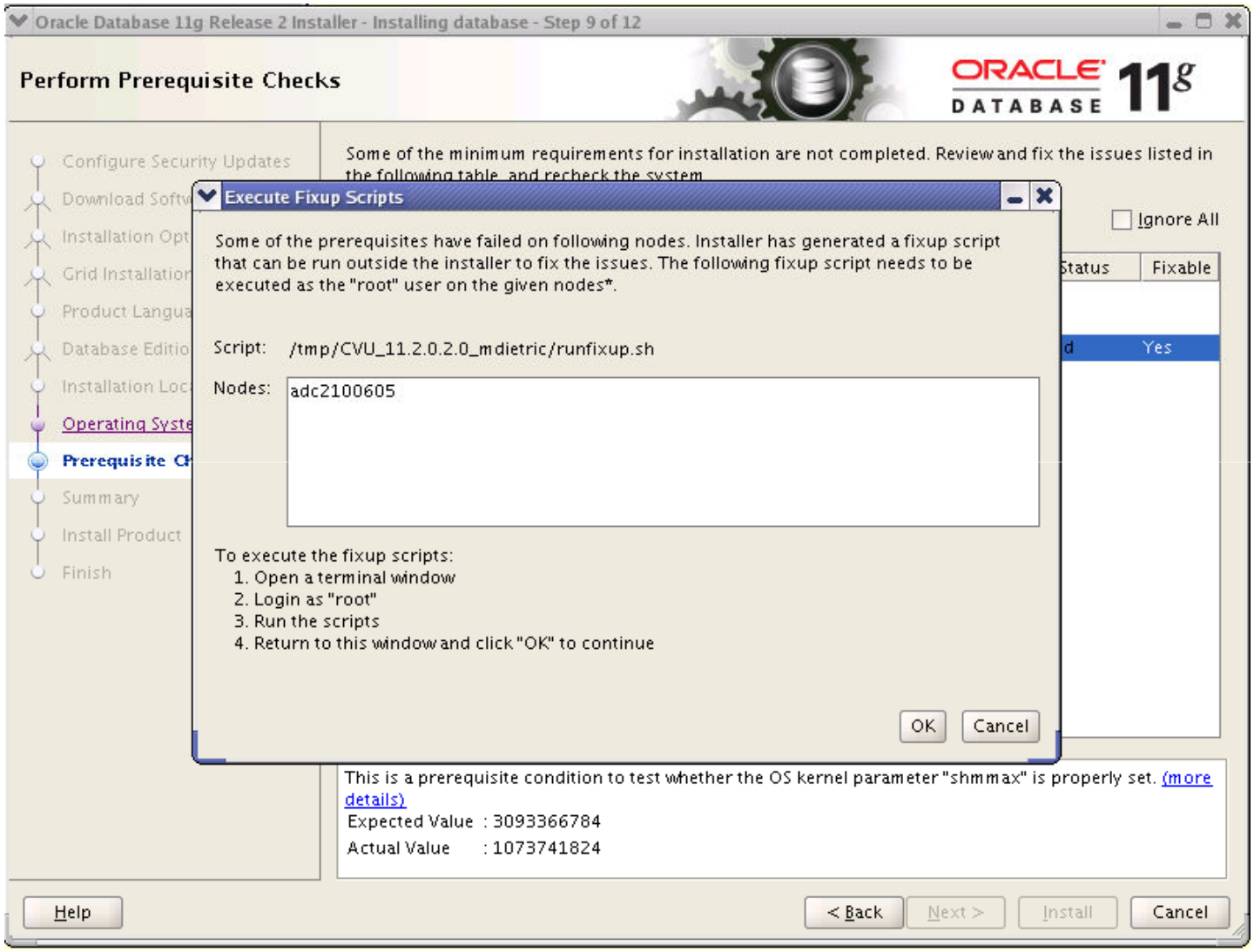
Installation 11*g* Release 2



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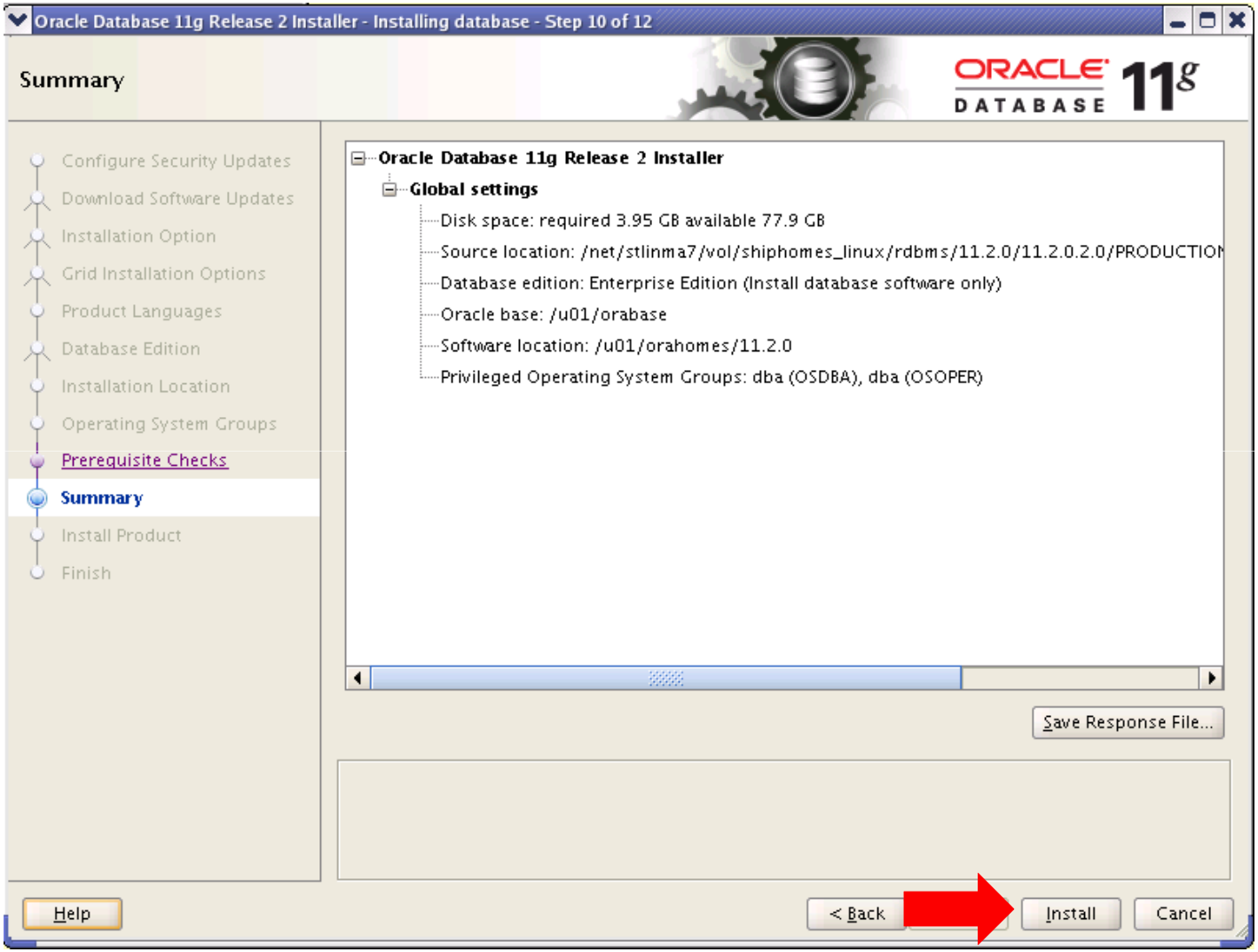
Installation 11*g* Release 2



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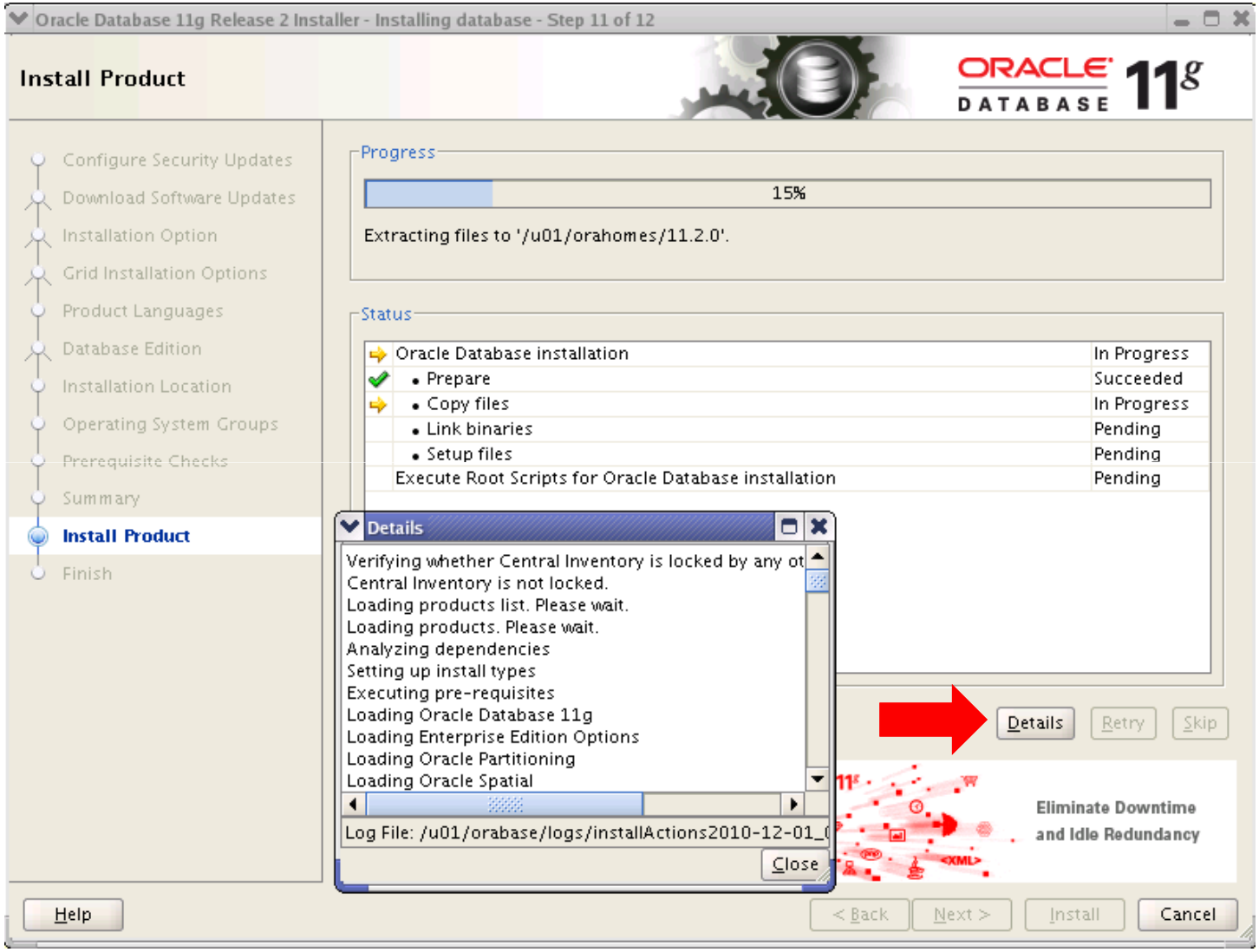
Installation 11*g* Release 2



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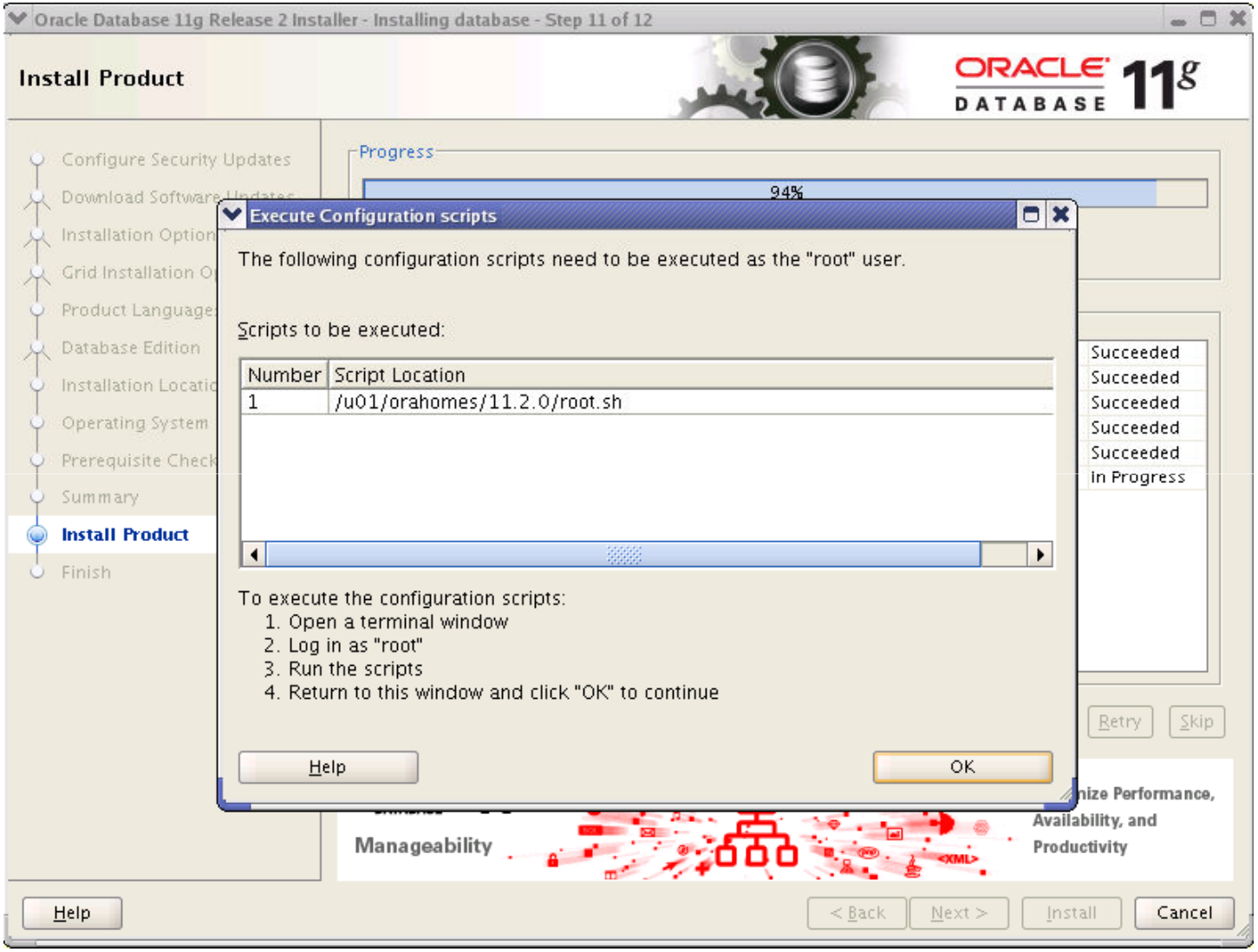
Installation 11*g* Release 2



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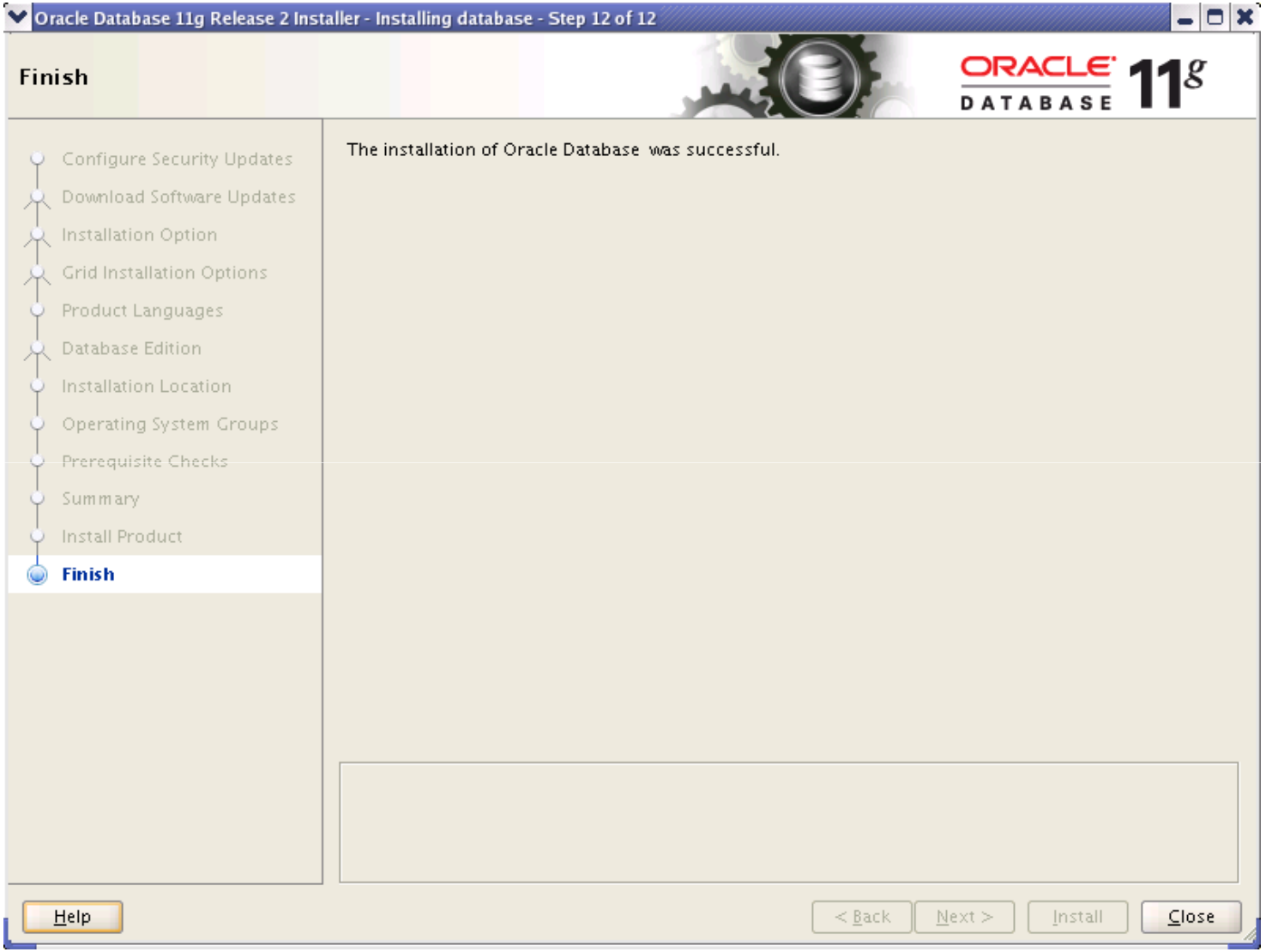
Installation 11*g* Release 2



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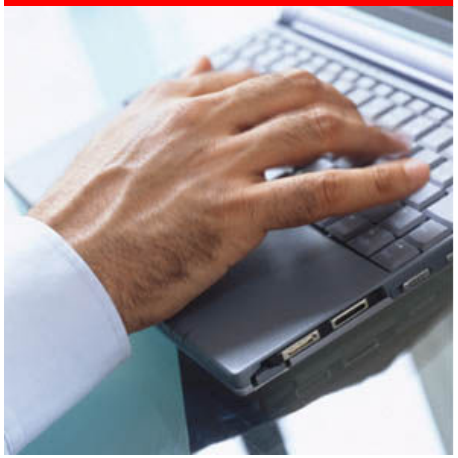
Agenda



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  - Unattended
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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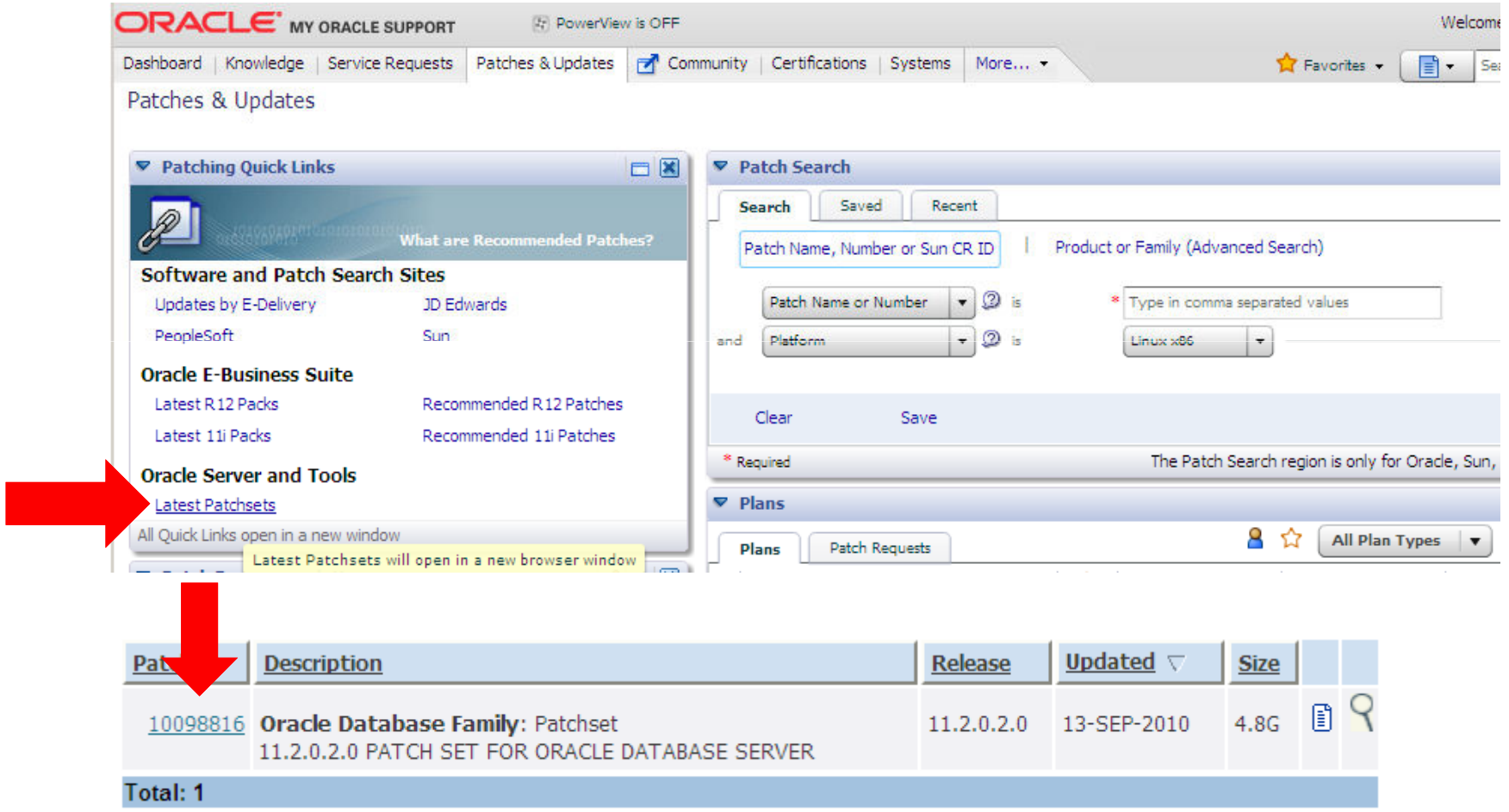
Patch Set Installation 11.2.0.2

- Download patch set 11.2.0.2 from support.oracle.com:



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Patch Set Installation 11.2.0.2

- Default: out-of-place patch upgrade!!! It's a full release!!!
  - If you specify an in-place patch upgrade from 11.2.0.1 to 11.2.0.2:

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Patch Set Installation 11.2.0.2

- Patch set 11.2.0.2 is a full release
  - Therefore no need anymore to install 11.2.0.1 first!!!
- Only way to do an in-place patch set installation
  - Backup your `/dbs` and `/network/admin` files
  - `./runInstaller -detachHome ORACLE_HOME=<11.2.0.1-home>`

```
$ ./runInstaller -detachHome ORACLE_HOME=/u01/orahomes/11.2.0
Starting Oracle Universal Installer...

Checking swap space: must be greater than 500 MB.   Actual 10047 MB    Passed
The inventory pointer is located at /etc/oraInst.loc
The inventory is located at /u01/orabase
'DetachHome' was successful.
```

  - Remove your 11.2.0.1 home contents
  - Install 11.2.0.2 into the previous 11.2.0.1 home
  - Restore `/dbs` and `/network/admin` files
  - Upgrade your database with DBUA or `catupgrd.sql`

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Patch Set Installation 11.2.0.2

- Recommendation: out-of-place patch upgrade!!!
  - In case an in-place patch upgrade is required:

Steps for in-place upgrade

/*Single Instance Database*/

1. Back up of the configuration data i.e; ORACLE_HOME/dbs and ORACLE_HOME/network/admin directories.
2. **Detach the 11.2.0.1 ORACLE_HOME with the following command**
   `./runInstaller -detachHome ORACLE_HOME=<11.2.0.1.0 software location>`
3. Remove 11.2.0.1.0 ORACLE_HOME software directory.
4. Install 11.2.0.2.0 Software Only into the same location as 11.2.0.1.
5. Restore the back-ed up configuration data files (dbs and network/admin) onto 11.2.0.2 ORACLE_HOME software location.
6. Run the DBUA from ORACLE_HOME/bin directory and select the 11.2.0.1.0 database instance to upgrade it to 11.2.0.2.0.

/*Real Application Clusters Database Instance*/

1. Back up ORACLE_HOME/dbs and ORACLE_HOME/network/admin directories on all the cluster nodes.
2. Run the following command on each of the node to detach the 11.2.0.1.0 RAC DB ORACLE_HOME
   `./runInstaller -detachHome ORACLE_HOME=<11.2.0.1.0 software location>`
3. Remove 11.2.0.1.0 RAC DB ORACLE_HOME directory on all the nodes.
4. Install 11.2.0.2 Software only on all nodes.
5. Restore the back-ed up configuration data file (dbs and network/admin) onto 11.2.0.2 ORACLE_HOME software location on all the nodes.
6. Run the DBUA from 11.2.0.2 ORACLE_HOME/bin directory on the local node and select 11.2.0.1.0 rac database instance to upgrade it to 11.2.0.2.0

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Recommended Patches

- Recommended Patches: Note:756388.1

Introduction to Oracle Recommended Patches [ID 756388.1]

Modified 02-AUG-2010 *Type* ANNOUNCEMENT *Status* PUBLISHED

[*Japanese information:* 日本語版は こちら]

Introduction to Oracle Recommended Patches

- What are Recommended Patches?
- Benefits of Recommended Patches
- Common Questions

What are Recommended Patches?

Oracle has introduced a set of Recommended Patches which make it easier for customers to obtain and deploy fixes for known critical issues encountered in targeted environments and configurations. As part of Oracle's overall maintenance strategy, these provide proactive patch recommendations to customers seeking to upgrade or to improve the stability of their current environments. Customers are advised to install Recommended Patches that apply to their environment.

Recommended Patches are available for products listed below. For details, please review the My Oracle Support notes.

Product	My Oracle Support Note
Oracle Database	Note:756671.1
Oracle Enterprise Manager	Note:822485.1
Oracle Fusion Middleware	Note:859115.1

This note will be updated as Oracle announces Recommended Patches for other Oracle products.

Benefits of Recommended Patches

Oracle Recommended Patches provide the following benefits:

- They fix a set of critical issues commonly encountered in targeted environments and configurations.
- They stabilize production environments because the patches address known critical issues.
- They help save time and cost by eliminating rediscovery of known issues.
- They are tested as a single combined unit, resulting in increased quality and eliminating the risk of combining patches that are only independently tested.
- They make it easier to identify patches applicable for a targeted environment/configuration.

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Recommended Patches

- Recommended Database Patches: Note:756671.1

Oracle Recommended Patches -- Oracle Database [ID 756671.1]

Modified 13-OCT-2010 *Type* ANNOUNCEMENT *Status* PUBLISHED

Oracle Recommended Patches -- Oracle Database

- Target Configurations
- Patch Availability
- Current Recommended Patches
  - 11.2.0.2 Current Recommended Patches
  - 11.2.0.1 Current Recommended Patches
  - 11.1.0.7 Current Recommended Patches
  - 11.1.0.6 Current Recommended Patches
  - 10.2.0.5 Current Recommended Patches
  - 10.2.0.4 Current Recommended Patches
  - 10.2.0.3 Current Recommended Patches
- Conflict Resolution
- On Request
- Known Issues
- References

Beginning with release 10.2.0.3, Oracle releases Recommended Patches for Oracle Database. For an introduction to Recommended Patches, see Note:756388.1.

Target Configurations

Recommended Patches are provided for the following target configurations:

- Generic
- Real Application Clusters
- Data Guard
- Exadata
- Ebusiness Suite Certification

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Patch Set Update (PSU) Installation

- Install PSUs as well
  - Note:854428.1: Introduction to Database Patch Set Updates
  - Database PSUs include:
    - Fixes for critical issues that may affect a large number of customers and that are already proven in the field
    - Critical Patch Update (CPU) fixes
  - Database PSUs do not include:
    - Changes that require re-certification
    - Fixes that require configuration changes
  - Typically 50-100 new bug fixes per PSU – ***usually*** cumulative
  - Guaranteed to be RAC rolling installable
  - Will be released 4x per year on the same schedule as CPUs

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Important Alerts?

- Check for important alerts: Note:161818.1

Oracle Database Releases Status Summary

Release (Click to see Details)	Current Patch Set	Next Patch Set	Premier Support Ends	Extended Support Ends	Notes
11.2.0.X	11.2.0.2	11.2.0.3	Jan-2015	Jan-2018	Base release is 11.2.0.1. 11.2.0.2 Patch Set is a full release
11.1.0.X	11.1.0.7	None	Aug-2012	Aug-2015	Base release is 11.1.0.6. 11.1.0.7 is the terminal 11.1 Patch Set
10.2.0.X	10.2.0.5	None	Jul-2010	Jul-2013 First year of Extended Support to be free of charge.	10.2.0.5 is the terminal 10.2 Patch Set. Upgrade to 10.2.0.5 is **not** required immediately upon start of Extended Support. The end patching dates for 10.2.0.4 can be found in Note:742060.1 .
10.1.0.X	10.1.0.5	None	Jan-2009	Jan-2012	10.1.0.5 is the terminal 10.1 Patch Set. 10.1 is now in Extended Support - see Note:761713.1
9.2.0.X	9.2.0.8	None	Jul-2007	Jul-2010 Limited Extended Support is available from July 2010 to July 2012 on selected platforms. See the "Extended Support" details here First year Extended Support was free for 9.2	9.2.0.8 is terminal 9.2 Patch Set. The Free Extended Support period ended on 31-Jul-2008. See Note:392222.1

'click'

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Upgrade Information / Alerts

- Known issues in 11.2.0.x? See Note:880782.1

Base Release Information

Information in this section is relevant for the 11.2.0.1 Base Release and for 11.2 Patch Sets.

Support Status
For details of 11.2 desupport dates see the Lifetime Support Policy

Upgrade Information / Alerts
Interoperability support between Oracle Releases Note:207303.1

Notification of Changes in Future Releases
CURSOR_SHARING SIMILAR setting to be deprecated Note:1169017.1

Patch Sets

This section gives a summary of the patch sets available for Oracle 11g Release 2.
Note that the BASE release of Oracle 11g Release 2 is 11.2.0.1 .

Release	Comments
11.2.0.2	Oracle 11g Release 2 Patch Set 1 Availability and Known issues for 11.2.0.2 Note:1179474.1 List of fixes included in 11.2.0.2 Note:1179563.1
11.2.0.1	Oracle 11g Release 2 Base Release. Availability and Known issues for 11.2.0.1 Note:880707.1

Upgrade Information / Alerts

- Known issues in 11.2.0.2? See Note:1179474.1

11.2.0.2 Alerts / Issues

This section lists alerts and important issues relevant to 11.2.0.2 .

General Alerts / Issues

Bug/Doc	Description	Updated
Note 1191474.1*	Corrupt Undo. ORA-600 [2015] during transaction rollback in undo block for COMPRESS table	08/Mar/2011
10302203P	HPUX: ORA-27037 with HPUX error 251 (ENOSYS) during VXFS file operations	15/Dec/2010

Upgrade Issues

Bug/Doc	Description	Updated
Note:1268390.1	roothas.pl -patch / rootcrs.pl -patch Fail with 'Undefined subroutine'	14/Dec/2010
11664046	MRP0 ORA-328 on switchover to standby after upgrade to 11.2.0.2	22/Feb/2011
10400001	11.2 upgrade does not check if DV should be linked off (ORA-1031)	21/Feb/2011
10036834P	Linux Platforms: Patches not found upgrading Grid Infrastructure from 11.2.0.1 to 11.2.0.2	16/Sep/2010
9873405	ORA-600 [21028] during fast refresh after upgrade	02/Feb/2011

Issues introduced in 11.2.0.2

This section lists bugs **introduced** in 11.2.0.2 (if any). Such issues may be either serious or trivial but the aim is to list them all to help customers assess t
of applying the Patch Set on top of 11.2

Bug/Doc	Description	Updated
11816187	Wrong results / corruption from MERGE SQL with false predicate pull-up	09/Mar/2011
11719151	SQL Plan Management capture causes slowness	08/Mar/2011
11067251	False ora-979 with trunc(date, format) or round(date, format)	17/Feb/2011
10636231	High version count for INSERT .. RETURNING statements with reason INST_DRTLD_MISMATCH	04/Feb/2011

Recommended OS patches

- Note:169706.1: OS Installation and Configuration

Oracle Database on Unix AIX,HP-UX,Linux,Mac OS X,Solaris,Tru64 Unix Operating Systems Installation and Configuration Requirements Quick Reference (8.0.5 to 11.2) [ID 169706.1]

Modified 06-OCT-2010 *Type* BULLETIN *Status* PUBLISHED

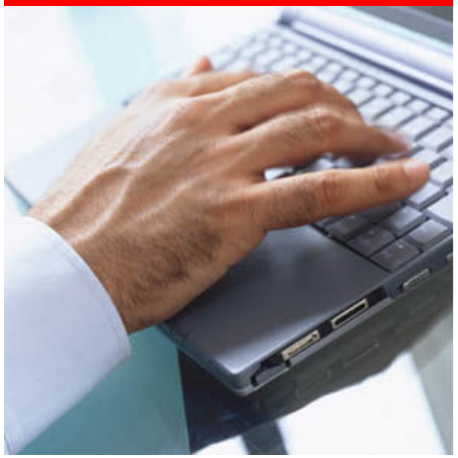
Jump to:

AIX
HP-UX (PA-RISC and Itanium)
Linux x86
Linux x86-64
Linux Itanium
Linux on Power
Linux on zSeries
Mac OS X (PowerPC and x86-64)
Solaris (SPARC and x86-64)
Tru64
Pre-Installation Scripts
OPatch
Related Documents
OS Specific Commands
Change History
Note 43208.1 Certified Compilers

Standby-First-Patching

- Oracle Data Guard Standby-First Patch Apply
  - Note:1265700.1 - Data Guard Standby-First Patch Apply
  - Apply a patch first on the physical standby site
  - Different software releases allowed between primary and standby
    - Role transitions allowed for rolling upgrades
  - Supported for:
    - Oracle Exadata Database Machine bundled patch
    - Oracle Exadata Storage Server Software patch
    - Patch Set Update (PSU)
    - Critical Patch Update (CPU)
    - One-off patch
  - Available beginning with Oracle Database 11.2.0.1
    - RDBMS COMPATIBLE must remain the same
    - ASM COMPATIBLE can be different

Agenda



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Time Zone Patches

- Taken from an Oracle internal information email:

In the Know News for Oracle Employees

3 MAR 2010

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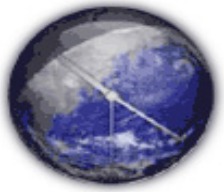
ARCHIVES
In the Know
Archives

Take Note: Daylight Saving Time is Beginning and Ending in Several Countries

Approximately 80 countries observe some form of Daylight Saving Time, and many are moving their clocks backward or forward at this time of year. For example



- **Brazil** Daylight Saving Time ended in most locations on **February 21**, 2010 (clocks moved back one hour).
- **U.S. and Canada** Daylight Saving Time begins in most locations on **March 14**, 2010 (clocks move forward one hour).
- In many **European countries**, Daylight Saving Time begins on **March 28**, 2010 (clocks move forward one hour).
- **Australia** Daylight Saving Time ends in some locations on **April 4**, 2010 (clocks will move back one hour).

China, India, and Japan are three of many countries that are not observing any form of Daylight Saving Time in 2010. For more details, view global participation status.

Daylight Saving Time (or summertime as it is called in many countries) is a way of getting more light out of the day by advancing clocks by one hour during the summer.

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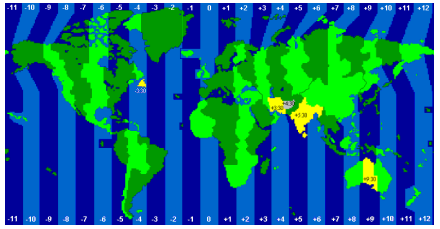
Time Zone Patches



- Why DST time zone patches? (DST: Daylight Savings Time)
  - Since 2007 DST definitions and time zone names have been changed several times
  - Time zone versions by release:
    - Oracle 9*i*: TZ V1
    - Oracle 10.1: TZ V2
    - Oracle 10.2.0.1/2: TZ V2
    - Oracle 10.2.0.3: TZ V3
    - Oracle 10.2.0.4: TZ V4
    - Oracle 11.1.0.6/7: TZ V4
      - Source release requires TZ V4 – otherwise no upgrade will be possible
    - Oracle 11.2.0.1: TZ V11
      - Beginning with 11.2.0.1 the source release does not have to be patched. Conversion will be done after upgrade
      - **BUT: If your source TZ version is already higher than target, then patch target database installation to the identical TZ version**
    - Oracle 11.2.0.2: TZ V14

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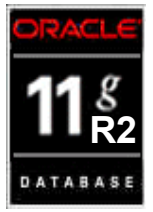
Time Zone Patches - 11*g* Release 2



- Upgrade to Oracle Database 11*g* Release 2:
  - 11.2.0.1-$OH has time zone V11, 11.2.0.2-$OH has time zone V14
  - No need to patch the source $OH
    - Except for TZ*source* > TZ*target*
  - Determine whether TimeZone updates are needed: Note:815679.1
  - Oracle recommends that you adjust the time zone version whether or not you use the `TIMESTAMP WITH TIME ZONE` data type
    - This data type may be used in system tables
    - Conversion done after the upgrade
    - See Note:977512.1
    - Package **`DBMS_DST`**

```
(1) DBMS_DST.BEGIN_PREPARE(<tz-version>)
    DBMS_DST.FIND_AFFECTED_TABLES
    DBMS_DST.END_PEPARE
    => select * from DST$AFFECTED_TABLES;
(2) DBMS_DST.BEGIN_UPGRADE
    DBMS_DST.UPGRADE_DATABASE
    DBMS_DST.END_UPGRADE
```

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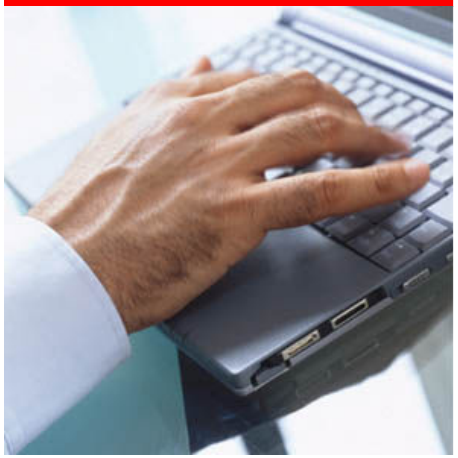
Agenda



- Preparation
- Installation
  - Installation Overview
  - Grid Infrastructure & ASM Installation
  - Patches
  - Time Zone
  - Unattended
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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Unattended Installation/Configuration

- Two options:
  - Oracle Universal Installer OUI
    - Until Oracle 11.1
      - ./runInstaller -record -destinationFile ...
      - ./runInstaller -silent -noconsole -responseFile ...
      - ⇨ But this has to be done for a patch set, too
    - Oracle 11.2 – see Note:885643.1
      - SAVE RESPONSEFILE option in OUI available
      - Or: Start OUI “silent” with all required parameters
  - Home Cloning (script or Provisioning Pack)
    - Prepare a fully patched Oracle Home
    - Create an archive consisting of all files
      - Exclude *log, *dbf, tnsnames/listener/sqlnet.ora
    - Unpack archive and then ./runInstaller -silent -clone -...
- Listener Configuration
    - ./netca /silent /responseFile $OH/inventory/response/netca.rsp

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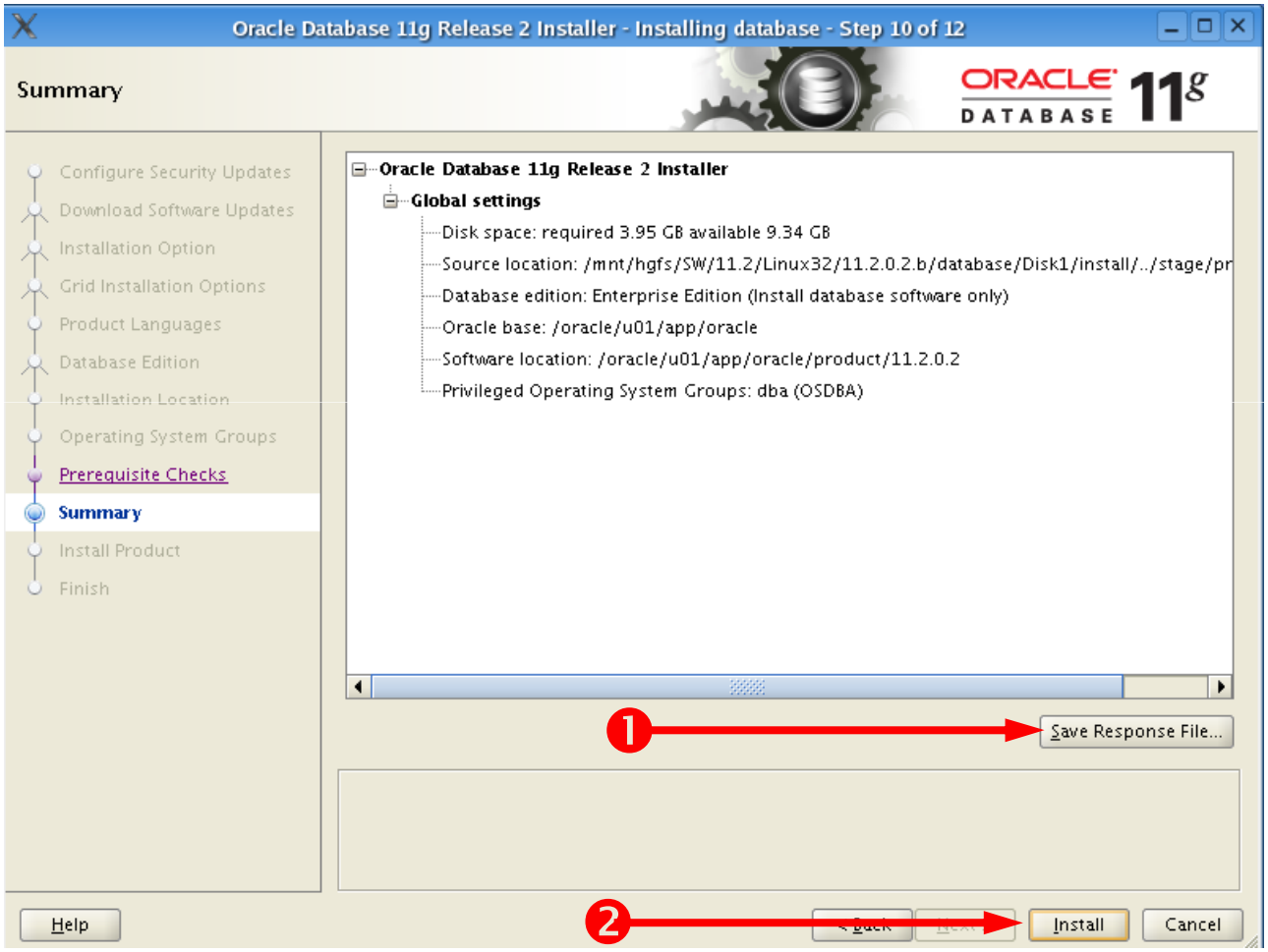
Unattended Installation/Configuration

- Oracle Database 11.2:



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Installation

- Overview on differences of database editions and available options by edition
  - Oracle® Database Licensing Information
    11g Release 2 (11.2)

    Part Number E10594-08
    http://download.oracle.com/docs/cd/E11882_01/license.112/e10594/toc.htm

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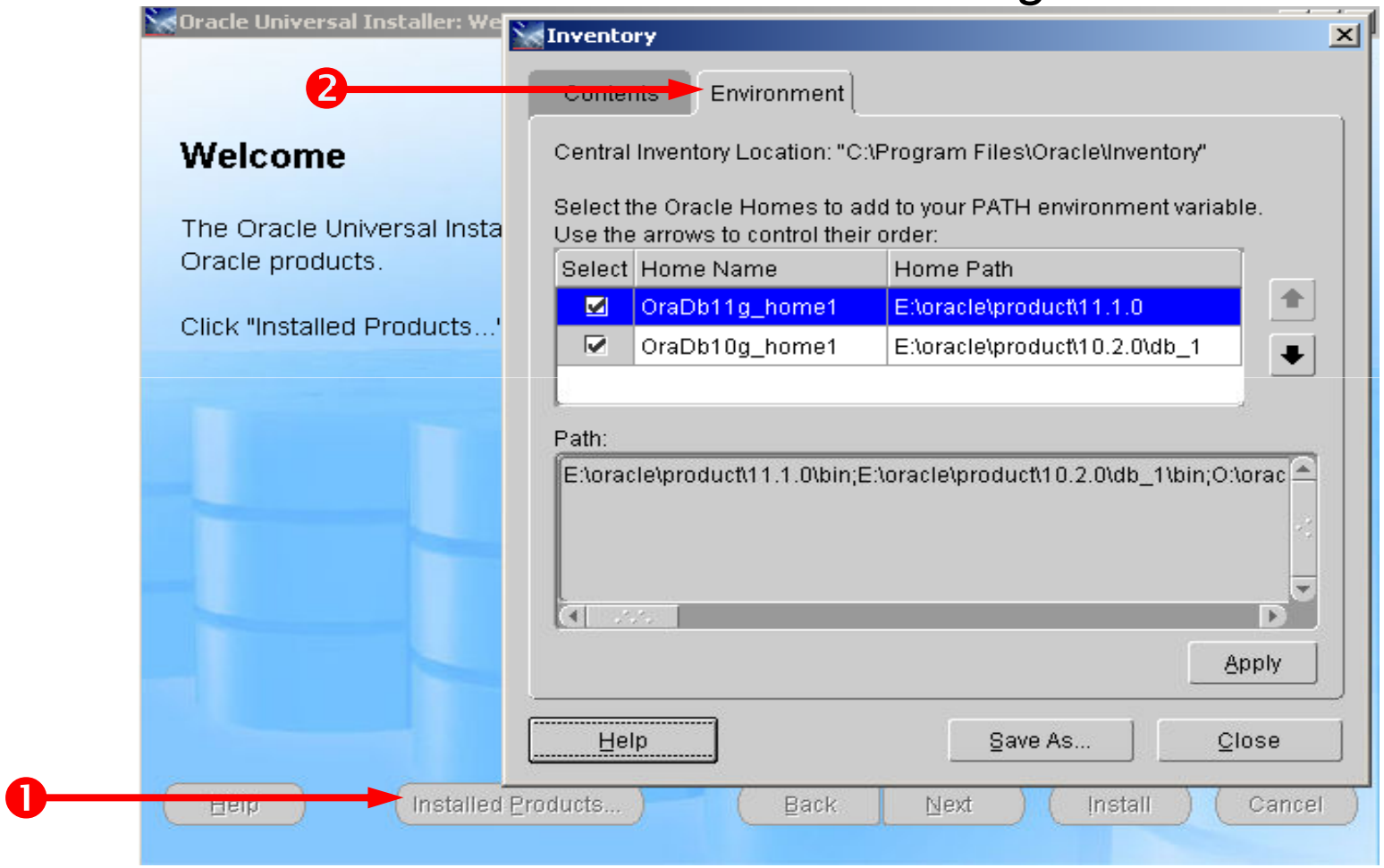
Installation

- Windows OS - Home Selector in 11*g* :



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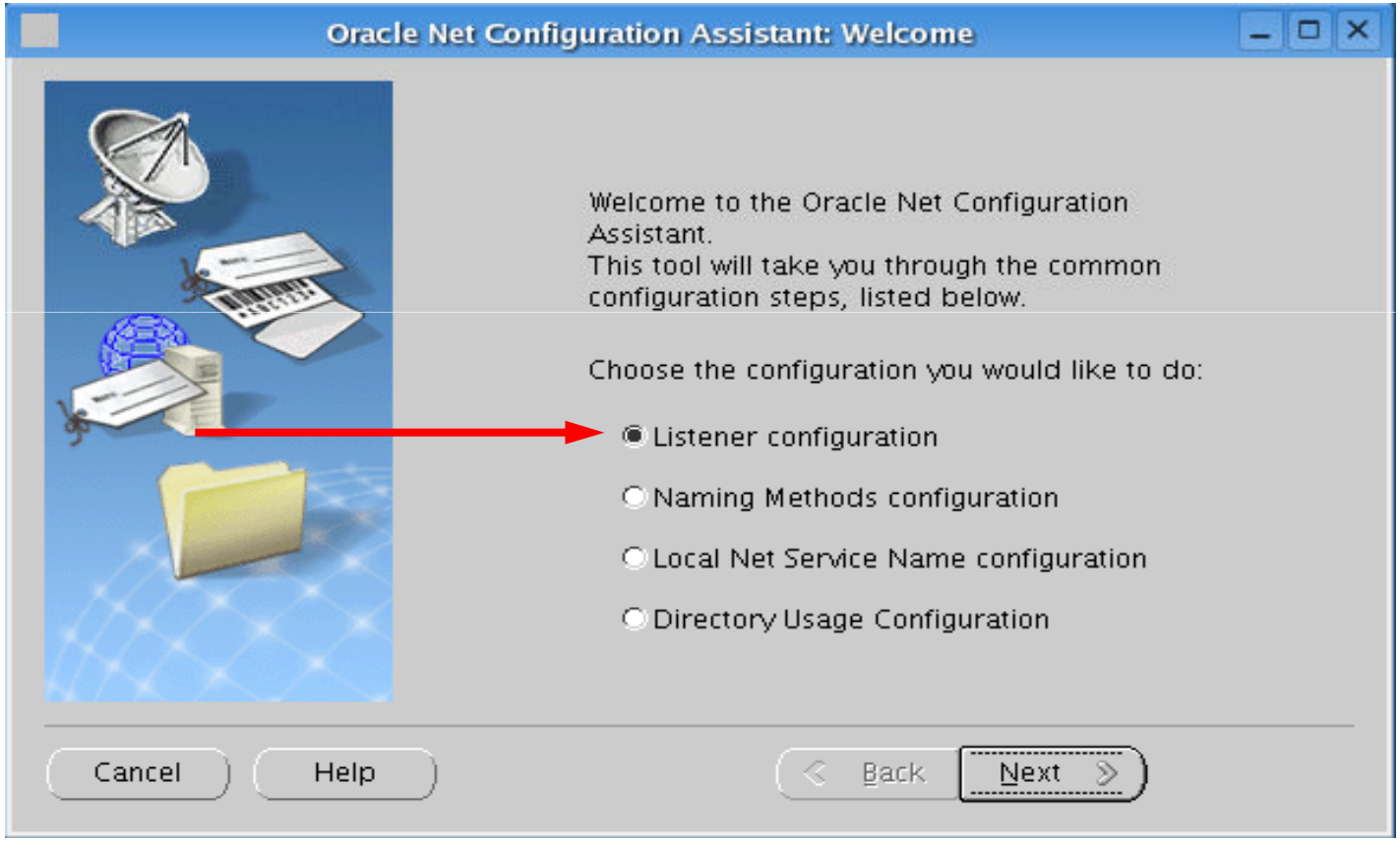
Listener Configuration

- Best Practices - strongly recommended:
  Create a new listener environment with NETCA:



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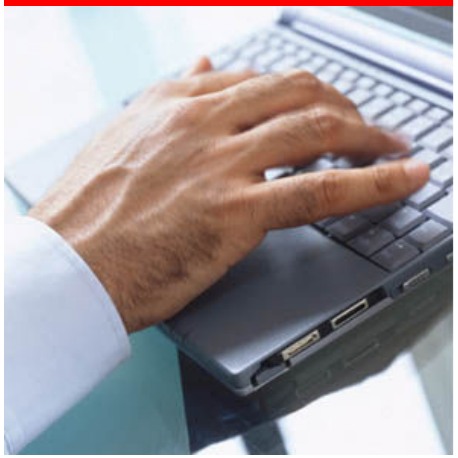
Agenda



- Preparation
- Installation
- Upgrade
  - Database Upgrade Assistant
  - Command Line Upgrade
  - Post Upgrade Alternatives
  - Migration
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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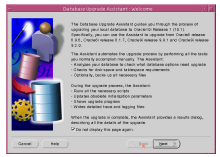
Database Upgrade Assistant (GUI)



- Features:
  - Graphically led upgrade
  - Lots of important checks
  - RAC *aware* - inclusion of all nodes
    - for RAC (almost) a must !!!
  - Offline Backup and Restore possible
  - ASM upgrade (until 11.1)
  - Oracle XE upgrade
  - Patch upgrades

  - Logs:
    - `$ORACLE_HOME/cfgtoollogs/dbua`

  - Documentation:
    - Oracle® Database Upgrade Guide
      http://download.oracle.com/docs/cd/E11882_01/server.112/e17222/toc.htm

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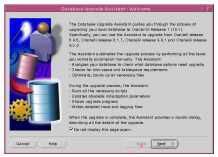
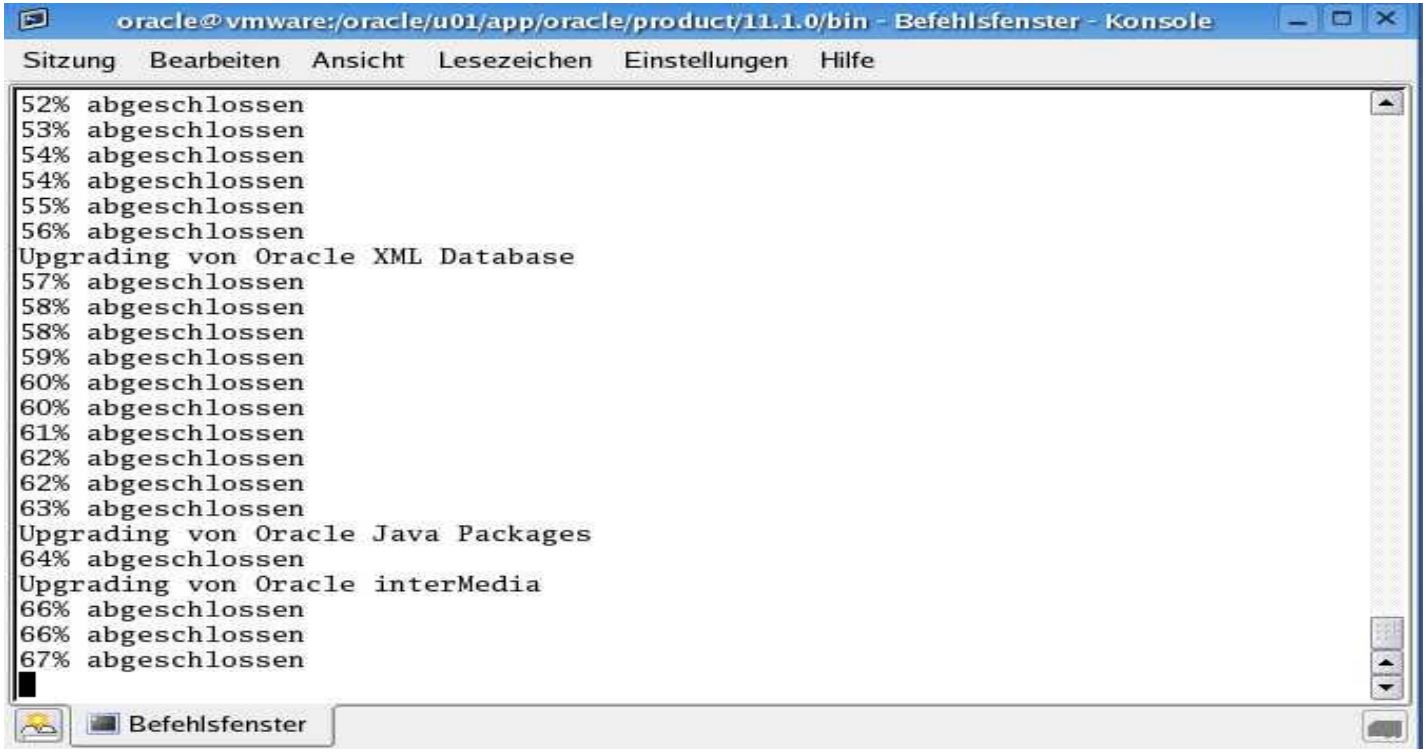
Database Upgrade Assistant (GUI)



- Silent mode:
  - `$ dbua -help` shows all valid options
  - See doc:
    http://download.oracle.com/docs/cd/E11882_01/server.112/e17222/upgrade.htm#sthref170



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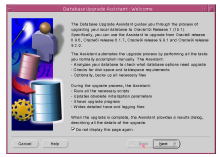
Database Upgrade Assistant (GUI)



- dbua [-silent] [-sid SID] [-oracleHome home_name]
  [-oracleBase base_name] [-diagnosticDest diagnostic_destination]
  [-sysDBAUserName SYSDBA_user] [-sysDBAPassword SYSDBA_pwd]
  [-upgradeASM] [-autoextendFiles] [-newGlobalDbName db_name]
  [-newSid new_SID] [-generateMapFile] [-useASM]
  [-commonFileLocation common_files] [-omfLocation omf_area]
  [-databaseMapFile map_file_name] [-newRecoveryArea recover_area]
  [-newRecoveryAreaSize recover_size] [-apexAdminPassword apex_pwd]
  [-disableUpgradeScriptLogging] [-backupLocation directory]
  [-sysauxTablespace -datafileName name -datafileSize size
  -datafileSizeNext size -datafileSizeMax size]
  [-postUpgradeScripts script [, script] ...]
  [-initParam parameter=value [, parameter=value] ...]
  [-disableArchiveLogMode] [-recompile_invalid_objects true | false]
  [-degree_of_parallelism cpu_number]
  [-emConfiguration {CENTRAL|LOCAL|ALL|NOBACKUP|NOEMAIL|NONE}
  -dbsnmpPassword password -sysmanPassword password
  -asmPassword password -hostUserName hostname
  -hostUserPassword password -backupSchedule hh:mm
  [-smtpServer server_name -emailAddress address]
  [-centralAgent location] [-localRacSid SID]]
  [-recoveryAreaDestination directory]
  [-h|-help]

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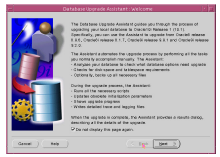
Database Upgrade Assistant (GUI)



- Example:

```
dbua -silent -sid dwh
-oracleHome /opt/oracle/product/RDBMS10g
-diagnosticDest /opt/oracle/diag
   -sysDBAUserName sys
   -sysDBAPassword manager
-recompile_invalid_objects true
   -degree_of_parallelism 4
-emConfiguration LOCAL
   -dbsnmpPassword manager
   -sysmanPassword manager
```

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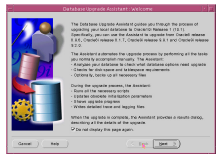
Database Upgrade Assistant (GUI)



- Best Practice: Before you start DBUA
  - Run `$OH_11g/rdbms/admin/`**`utlu112i.sql`** in your current environment
  - Check especially the components status in DBA_REGISTRY
    - To remove (or reinstall) components manually:
      Note:472937.1 Information On Installed Database Components
      Note:753041.1 How to diagnose Components with NON VALID status

```
**************************************************************************
Components: [The following database components will be upgraded or installed]
**************************************************************************
--> Oracle Catalog Views          [upgrade]  VALID
--> Oracle Packages and Types     [upgrade]  VALID
--> JServer JAVA Virtual Machine  [upgrade]  VALID
--> Oracle XDK for Java           [upgrade]  VALID
--> Oracle XML Database           [upgrade]  VALID
--> Oracle Java Packages          [upgrade]  VALID
```

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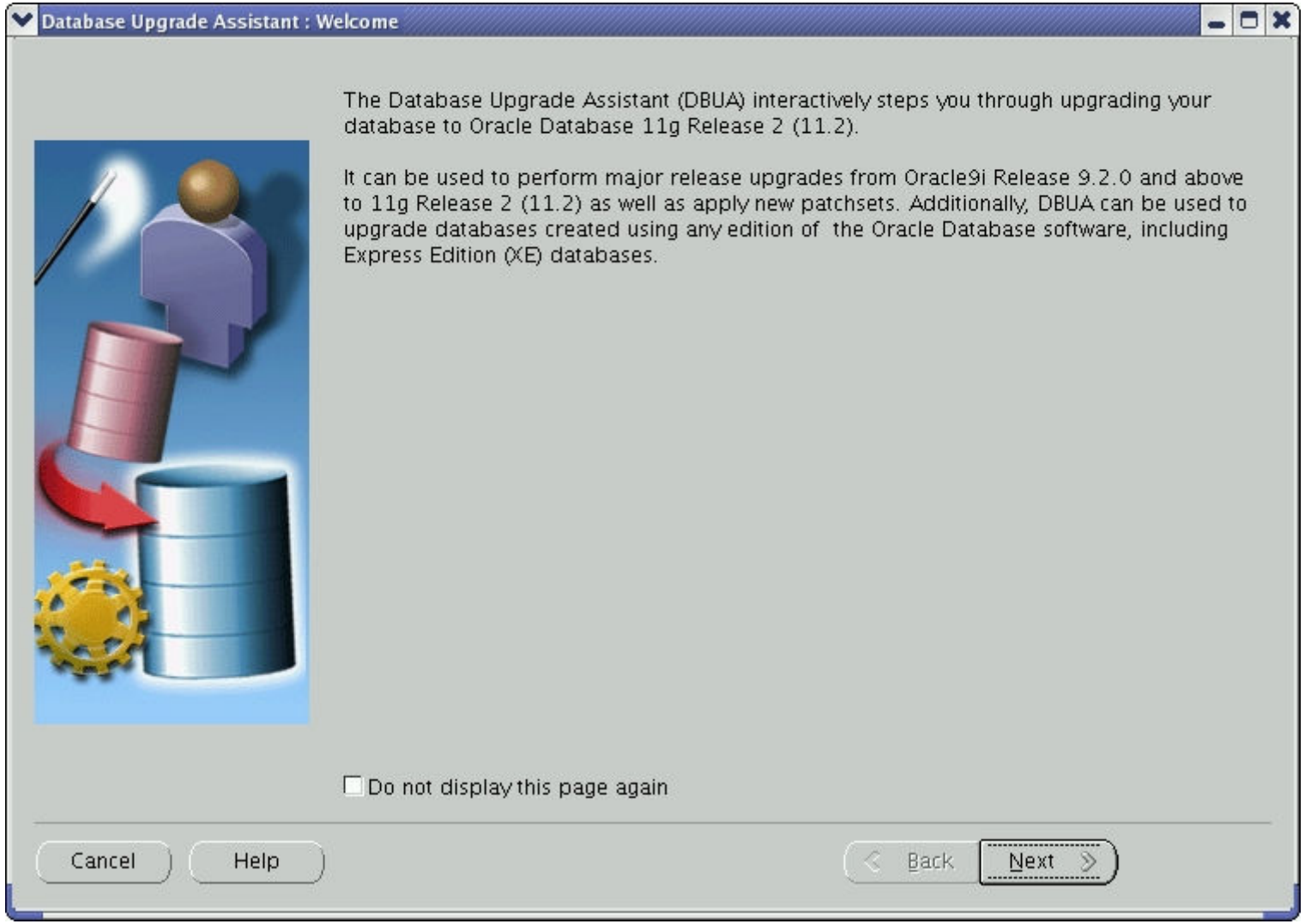
Database Upgrade Assistant (GUI)



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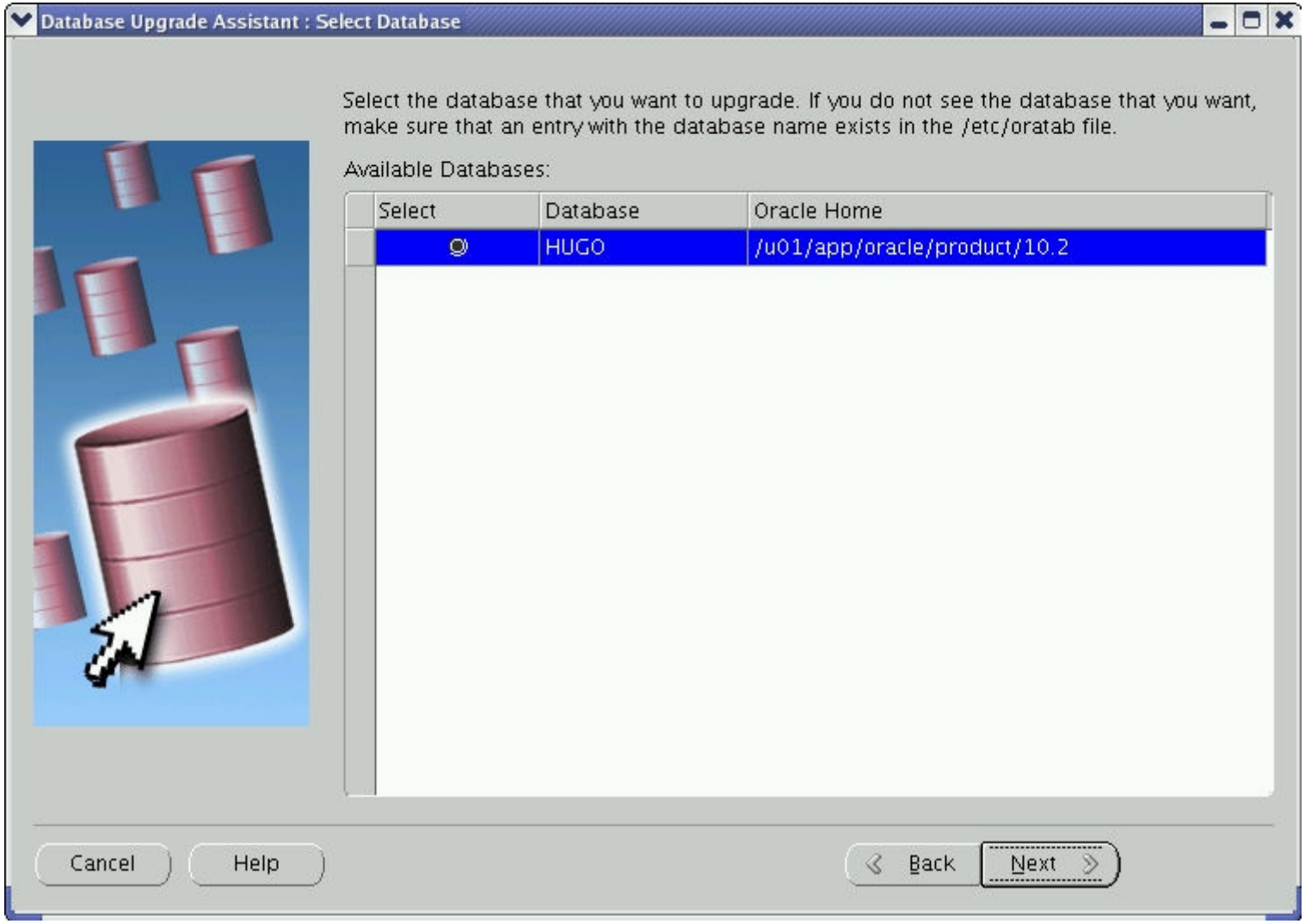
Database Upgrade Assistant (GUI)



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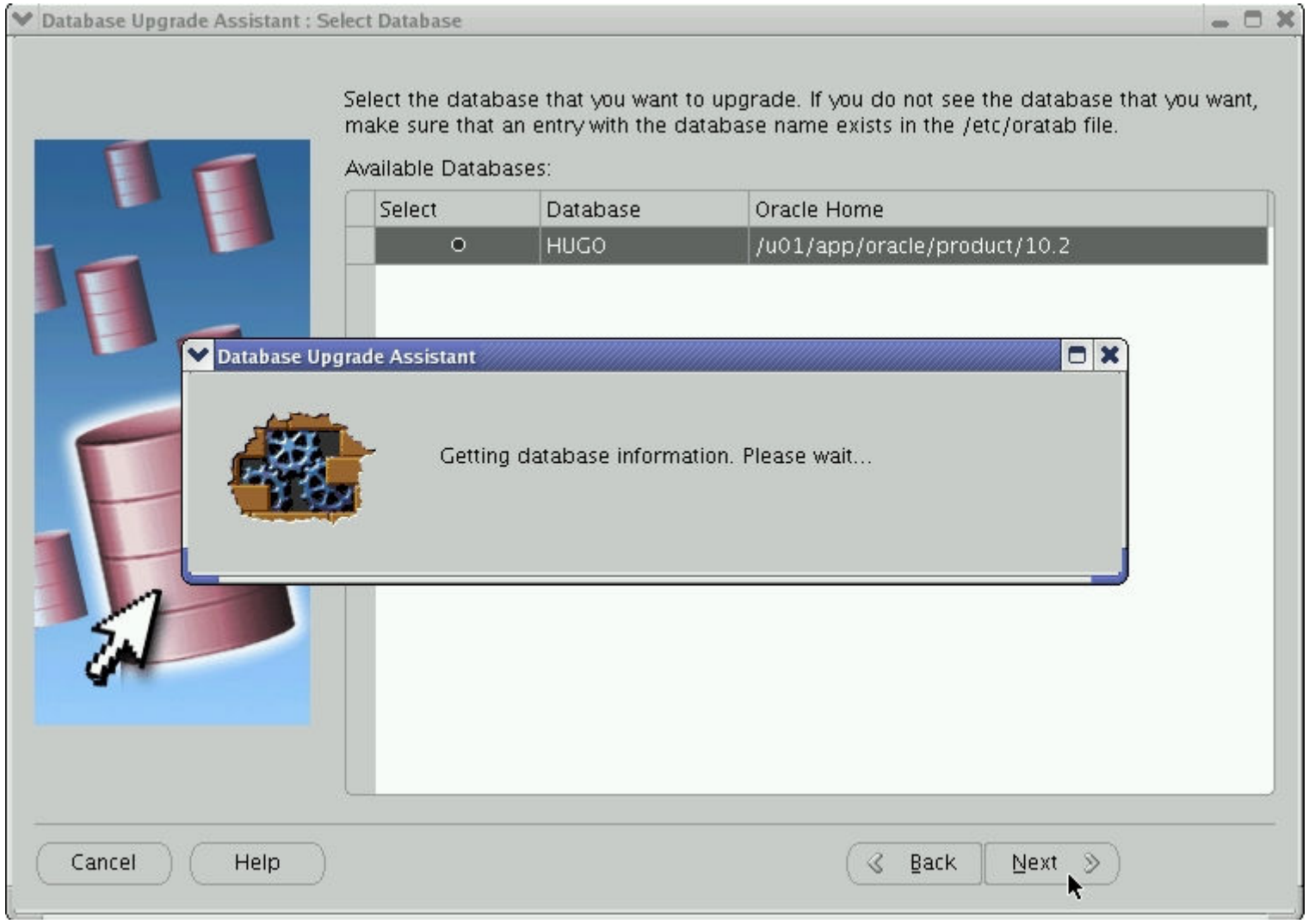
Database Upgrade Assistant (GUI)



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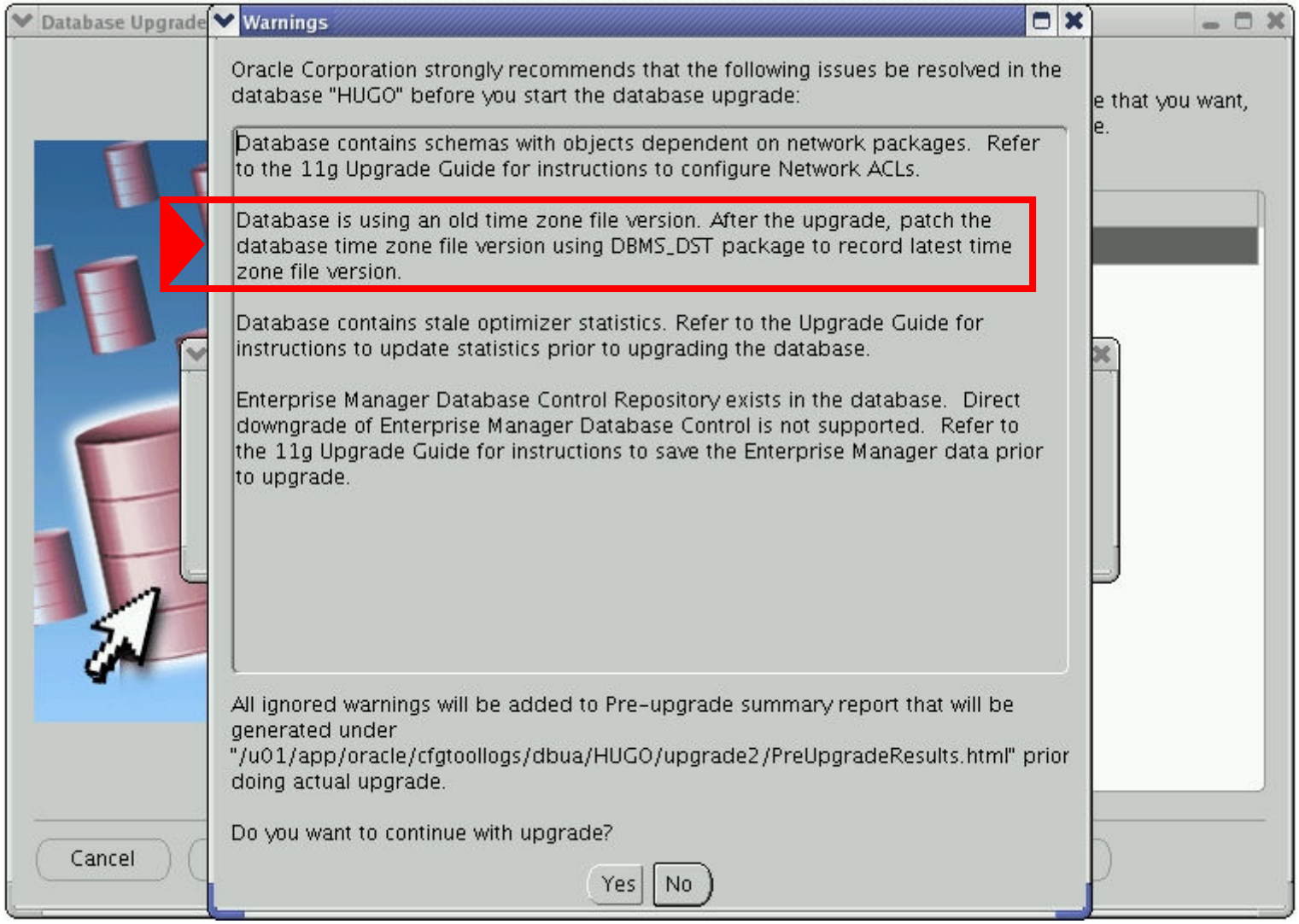
Database Upgrade Assistant (GUI)



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Network ACLs

- Make sure Oracle XML DB is installed if you use packges: `UTL_TCP`, `UTL_SMTP`, `UTL_MAIL`, `UTL_HTTP` and/or `UTL_INADDR`
- You must also configure network access control lists (ACLs) in the database after the upgrade before these packages can work as they did in prior releases
- Please see the Database Upgrade Guide for an example: http://download.oracle.com/docs/cd/E11882_01/server.112/e17222/upgrade.htm#sthref148 and MOS Note:958129.1 on how to setup Network ACLs

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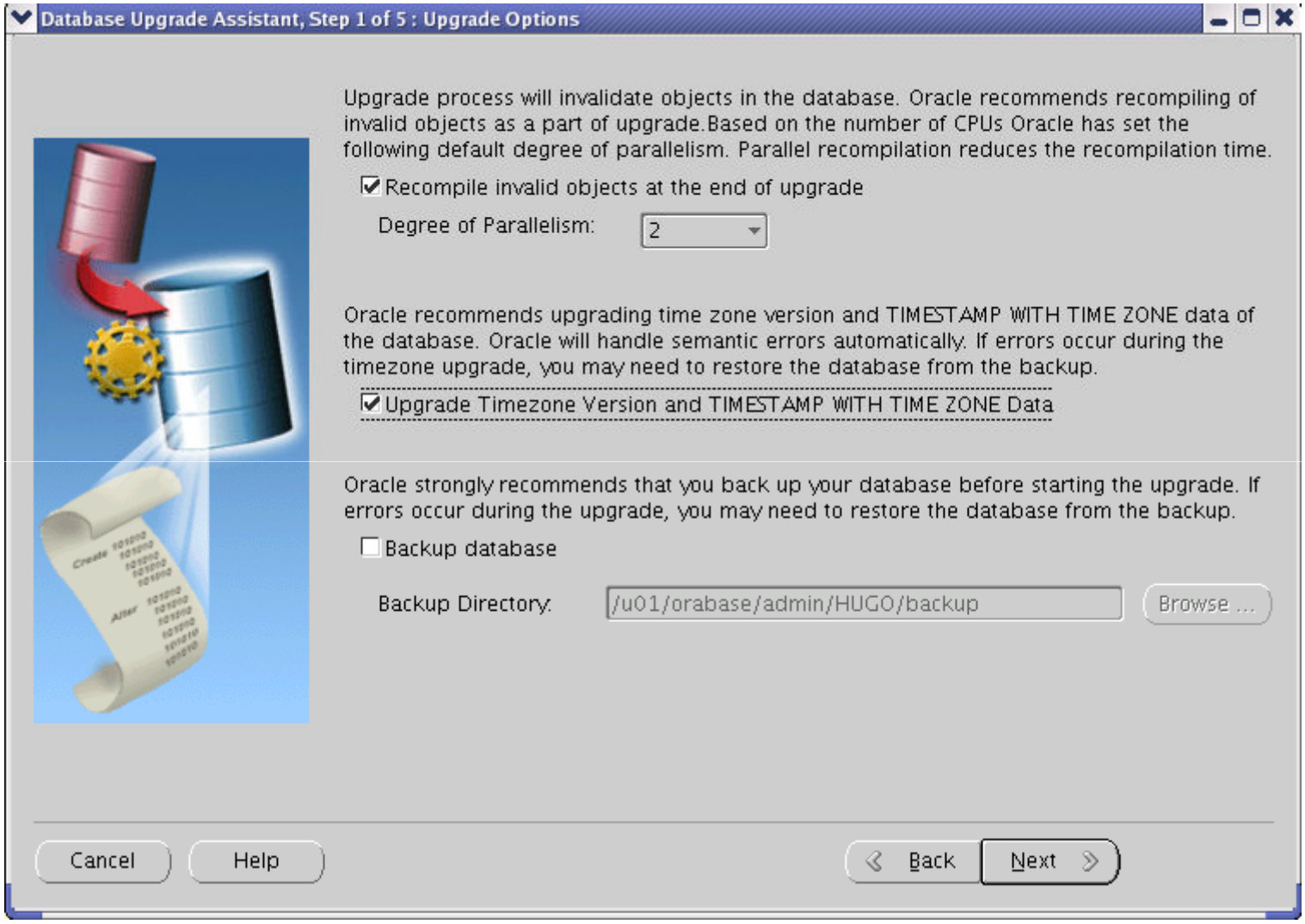
Database Upgrade Assistant (GUI)



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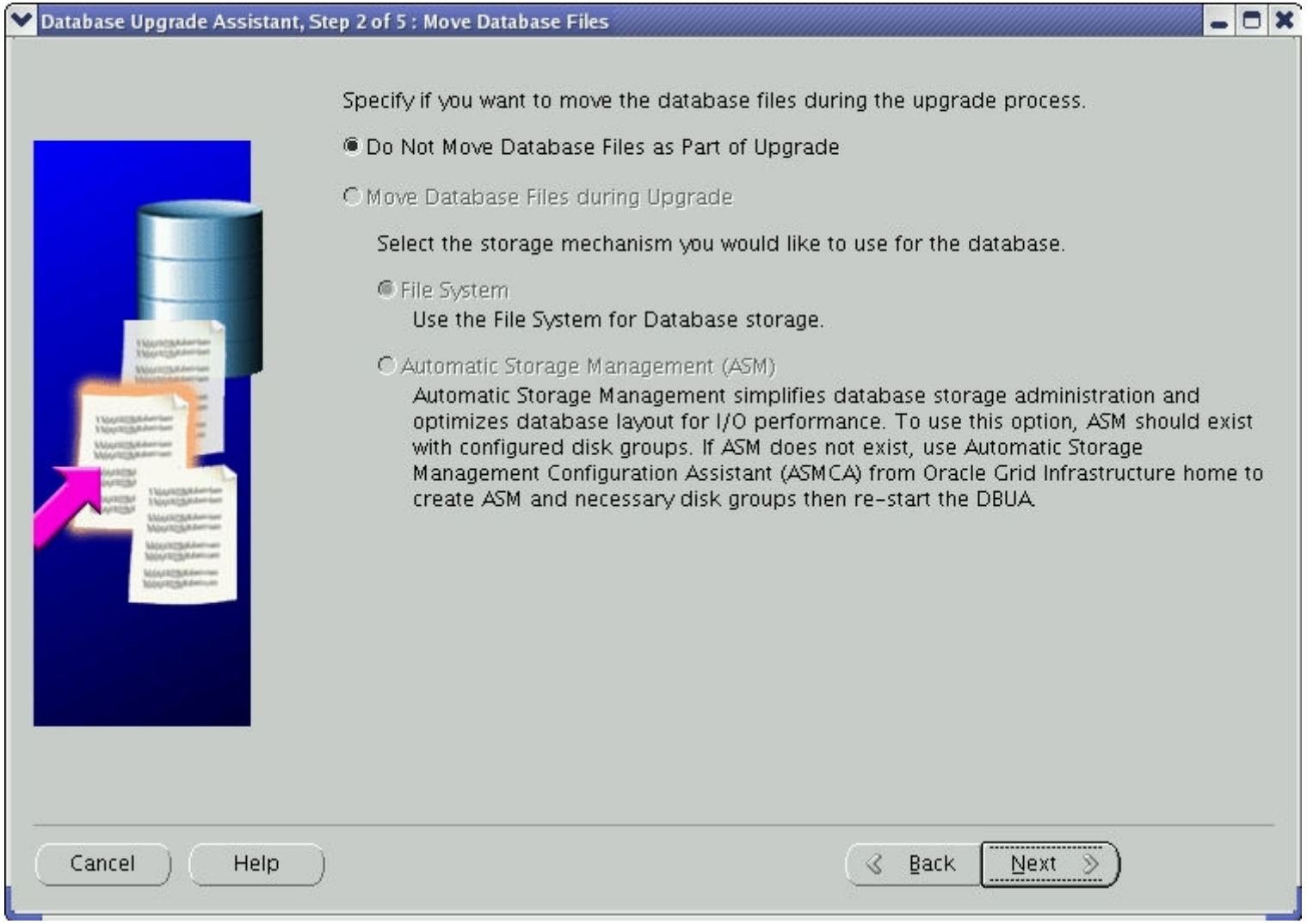
Database Upgrade Assistant (GUI)



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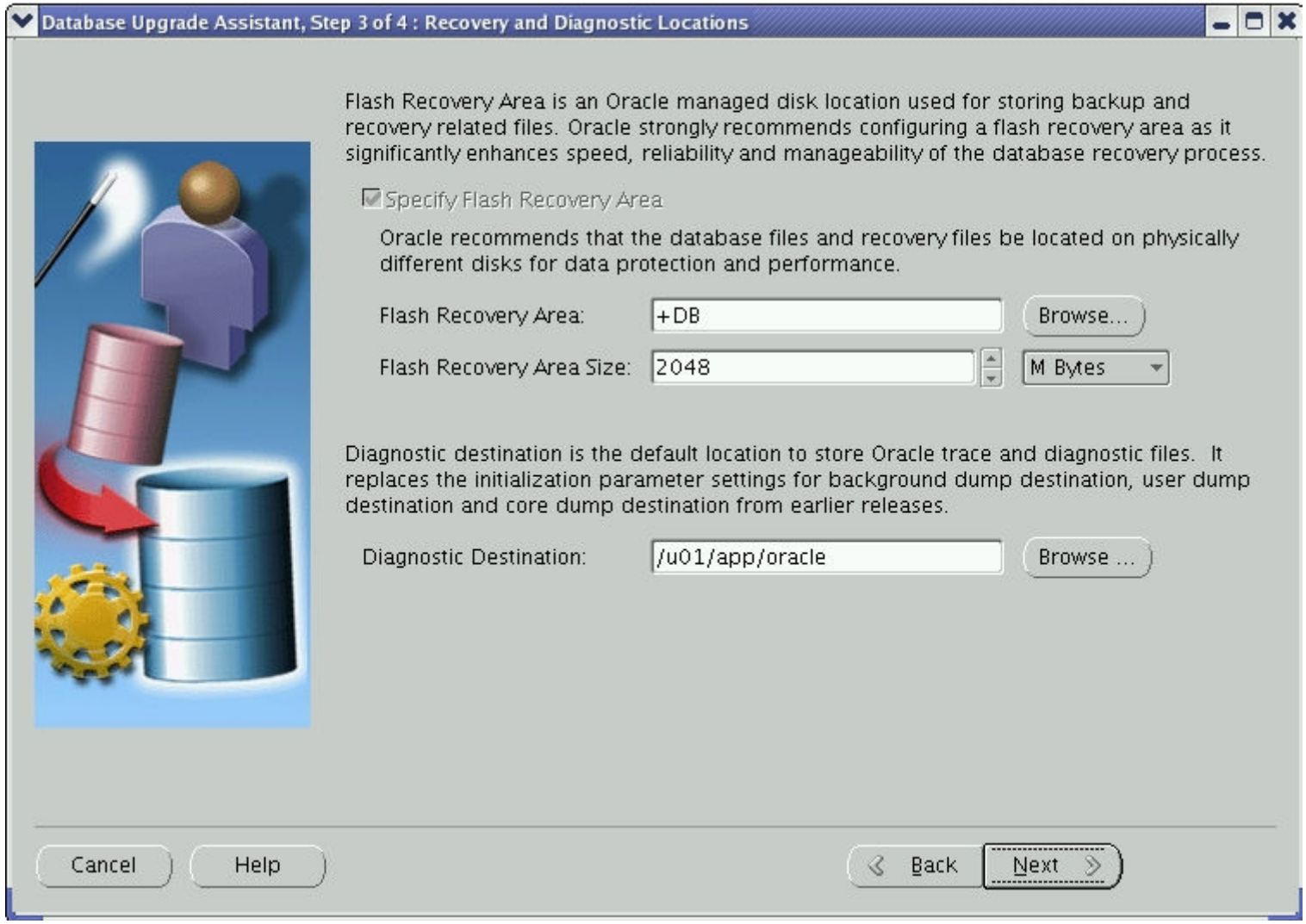

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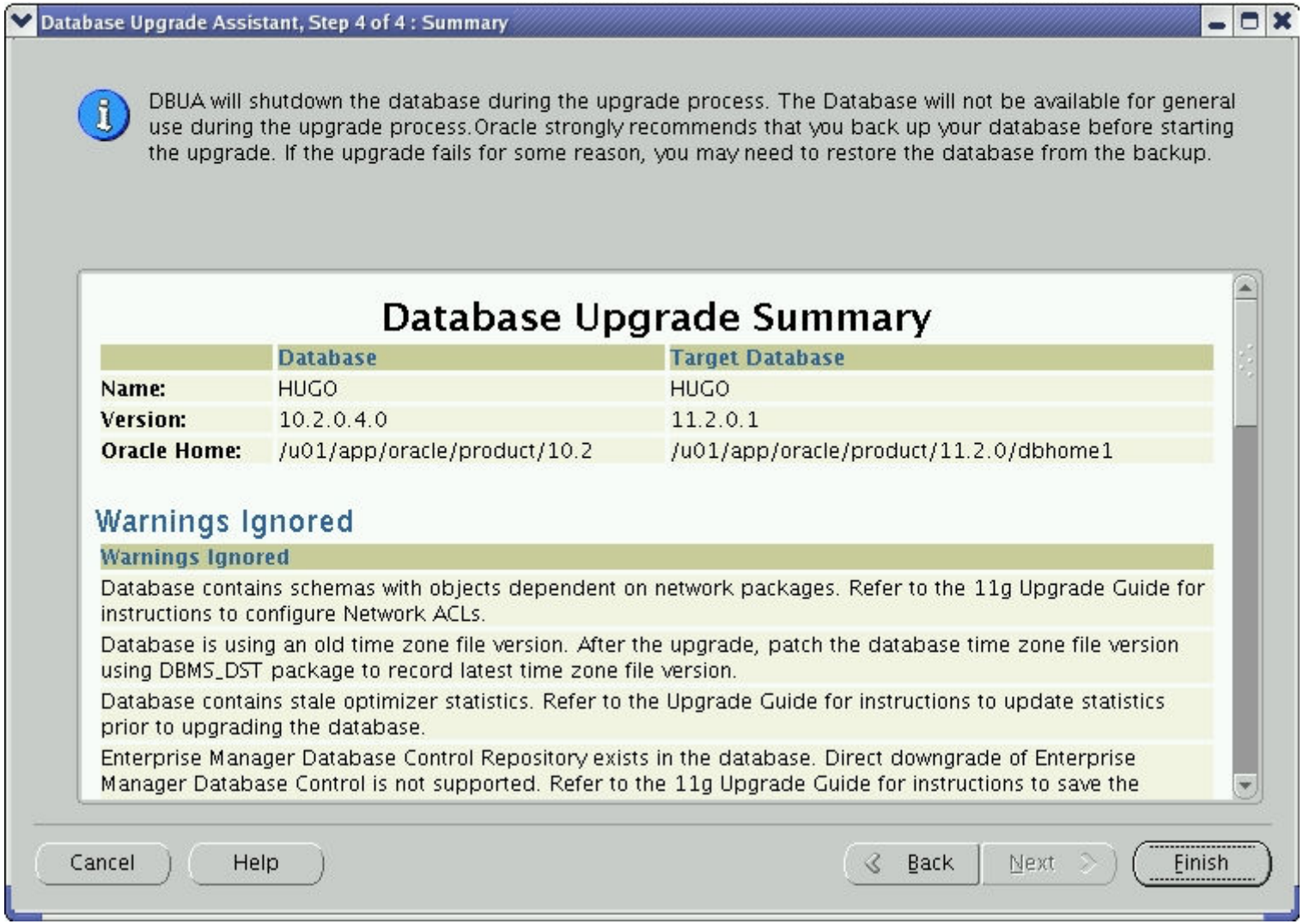

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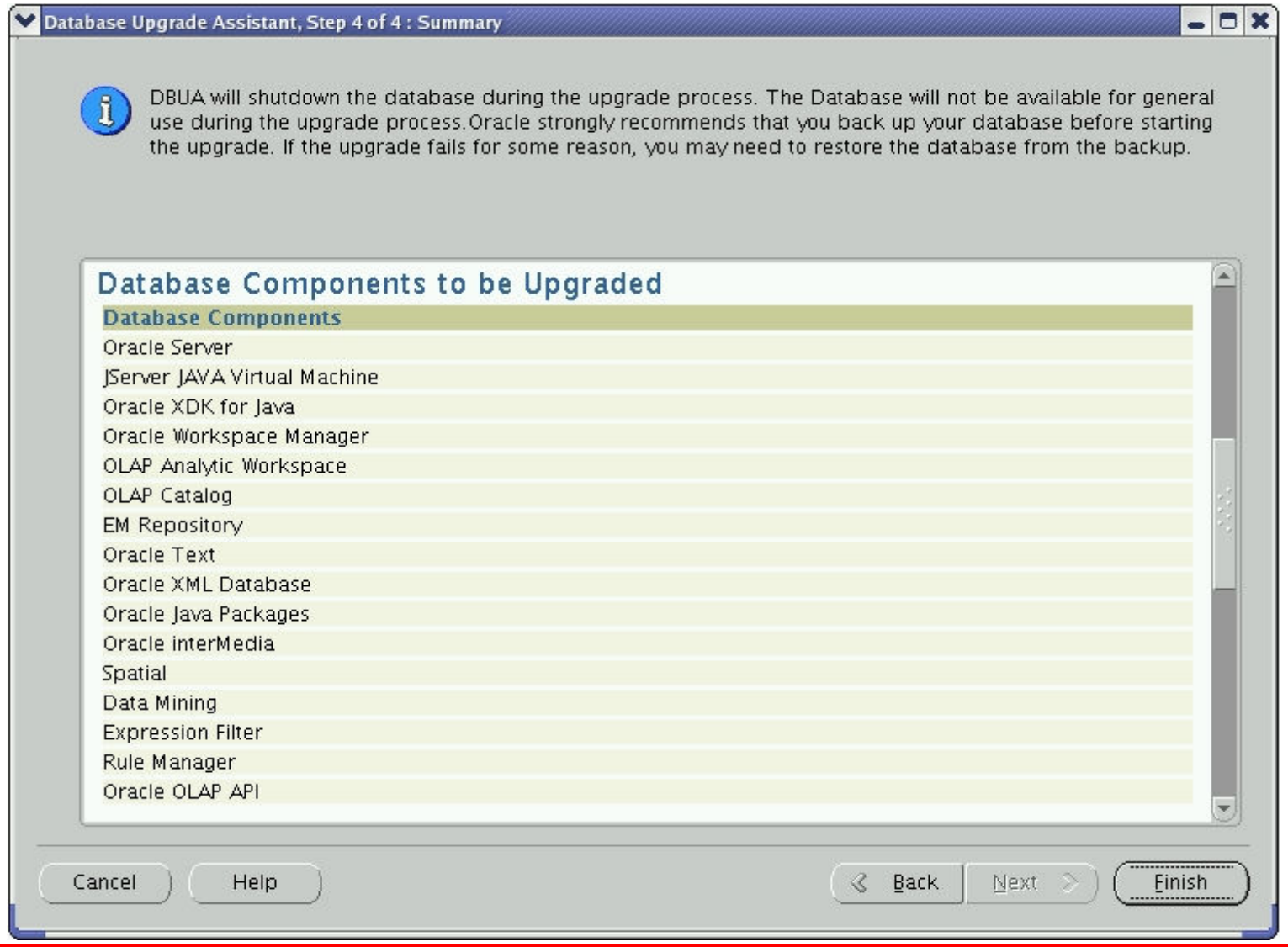
Database Upgrade Assistant (GUI)



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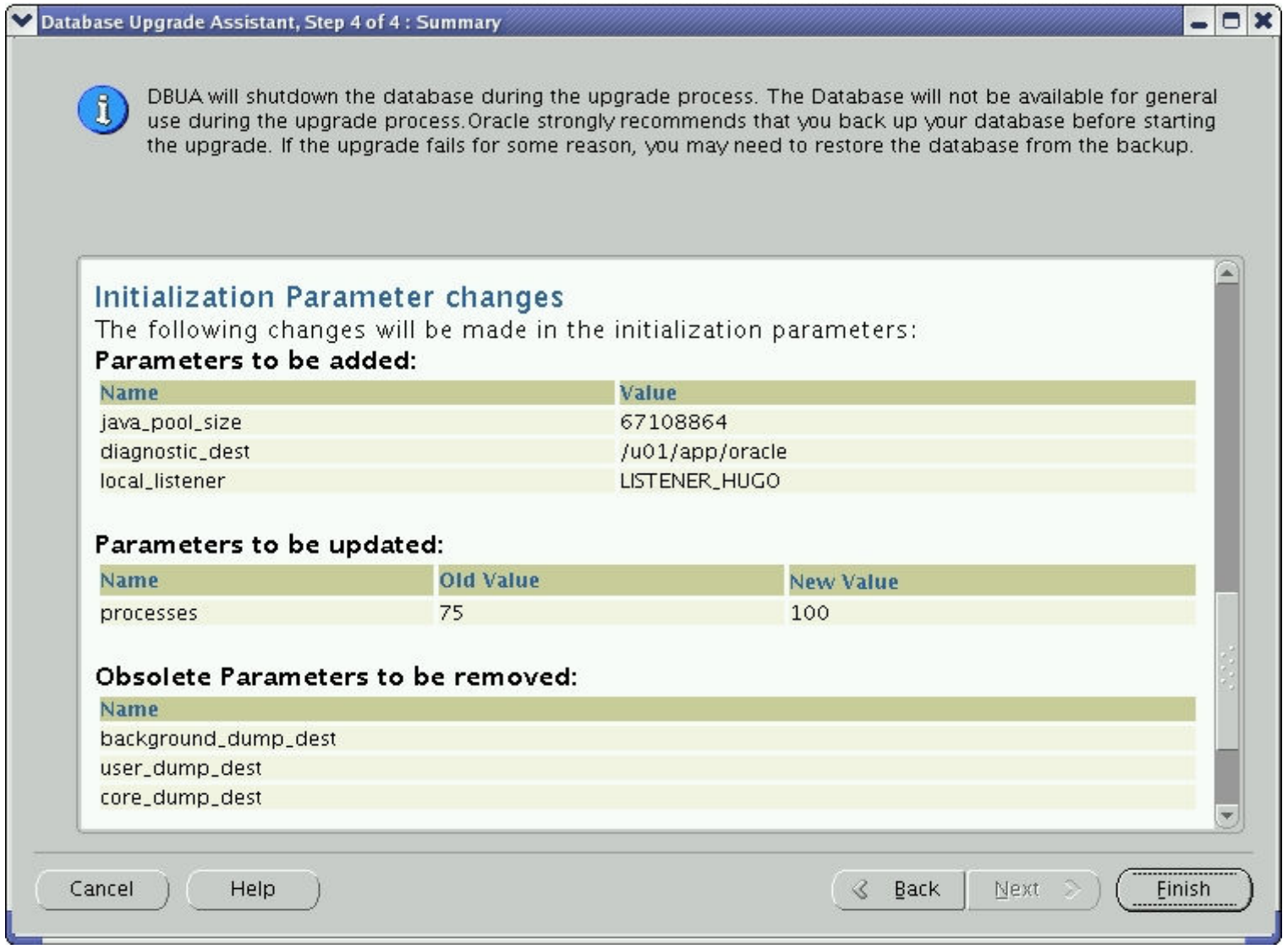
Database Upgrade Assistant (GUI)



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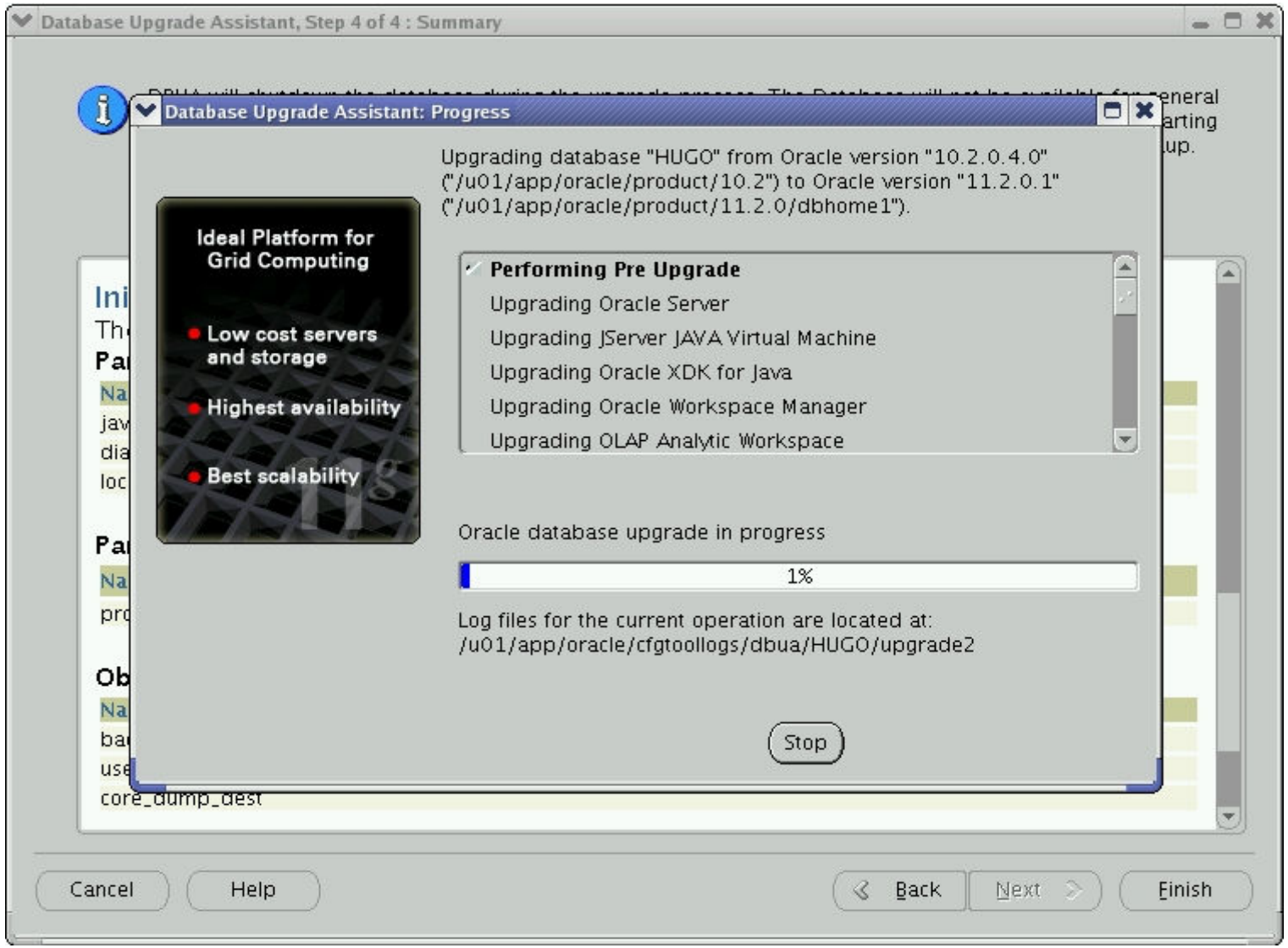
Database Upgrade Assistant (GUI)



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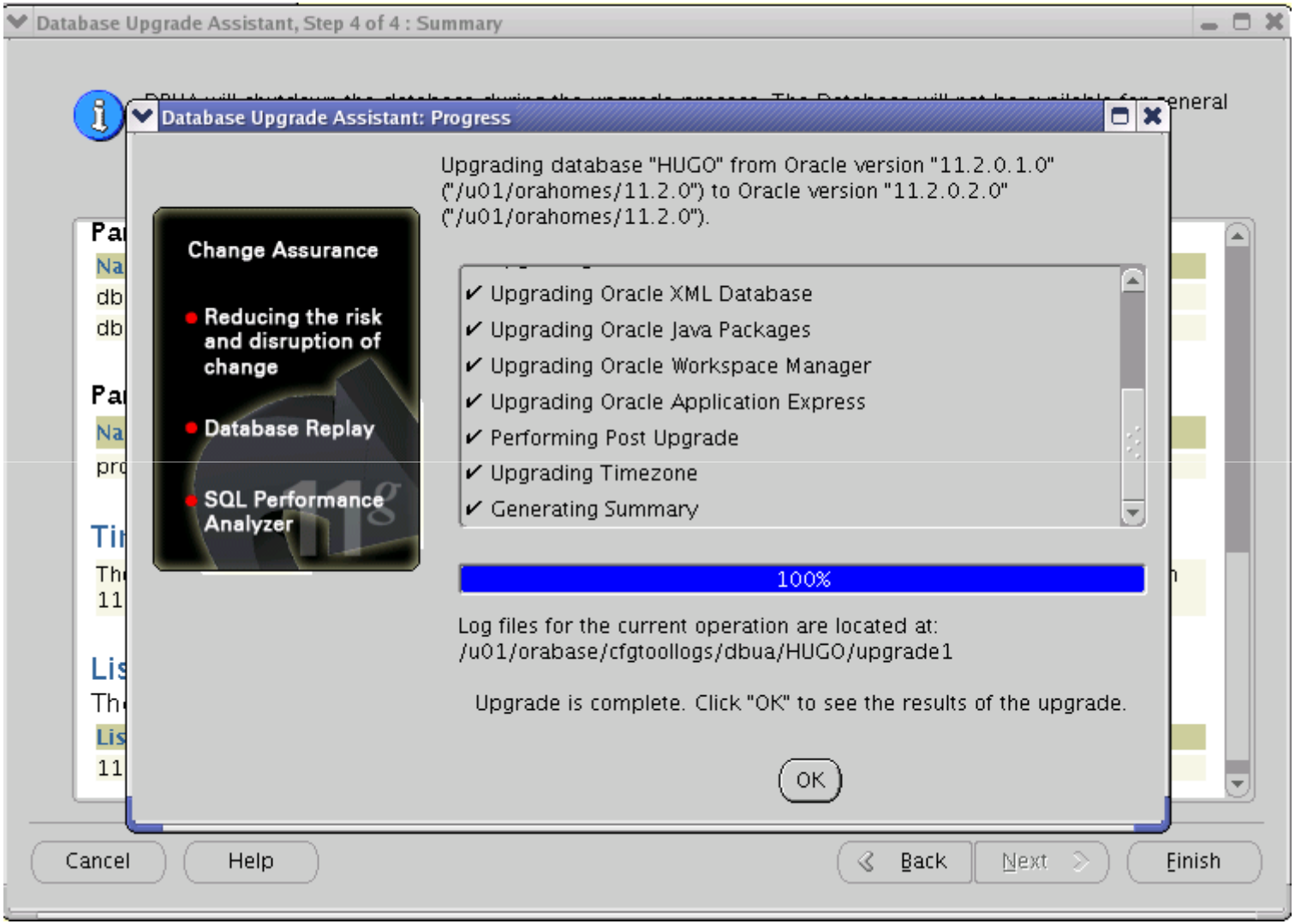
Database Upgrade Assistant (GUI)



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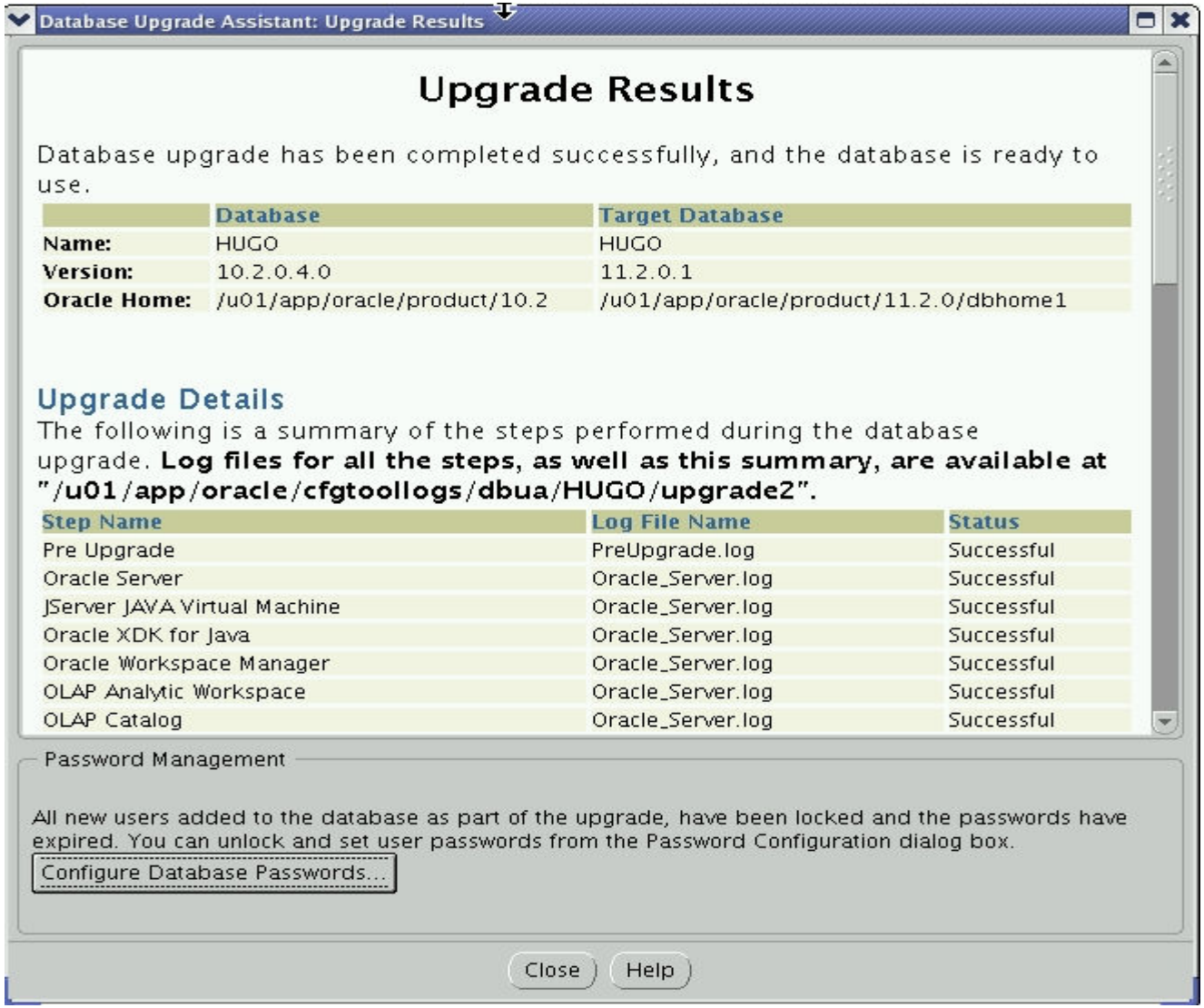
Database Upgrade Assistant (GUI)



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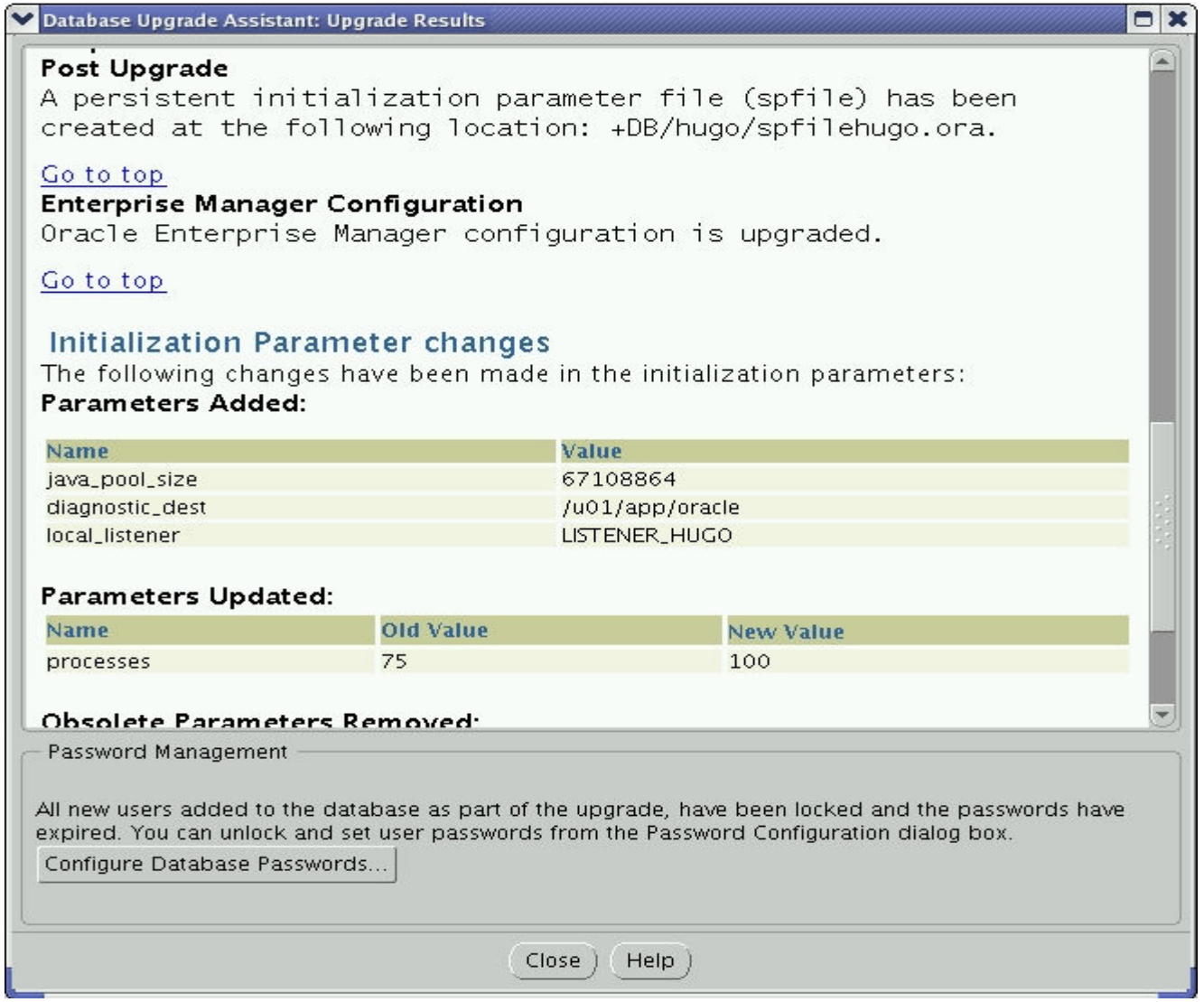
Database Upgrade Assistant (GUI)



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Database Upgrade Assistant (GUI)

- If you'd used the DBUA in an RAC/GI environment and you have a standby database in place make sure:
  - For Oracle 11.2.0.1 to 11.2.0.2/3:
    Use the `-upgrade` command line option of `srvctl` utility to upgrade OCR resource entries
  - For prior version of databases:
    Use: `srvctl -delete` and `srvctl -add`

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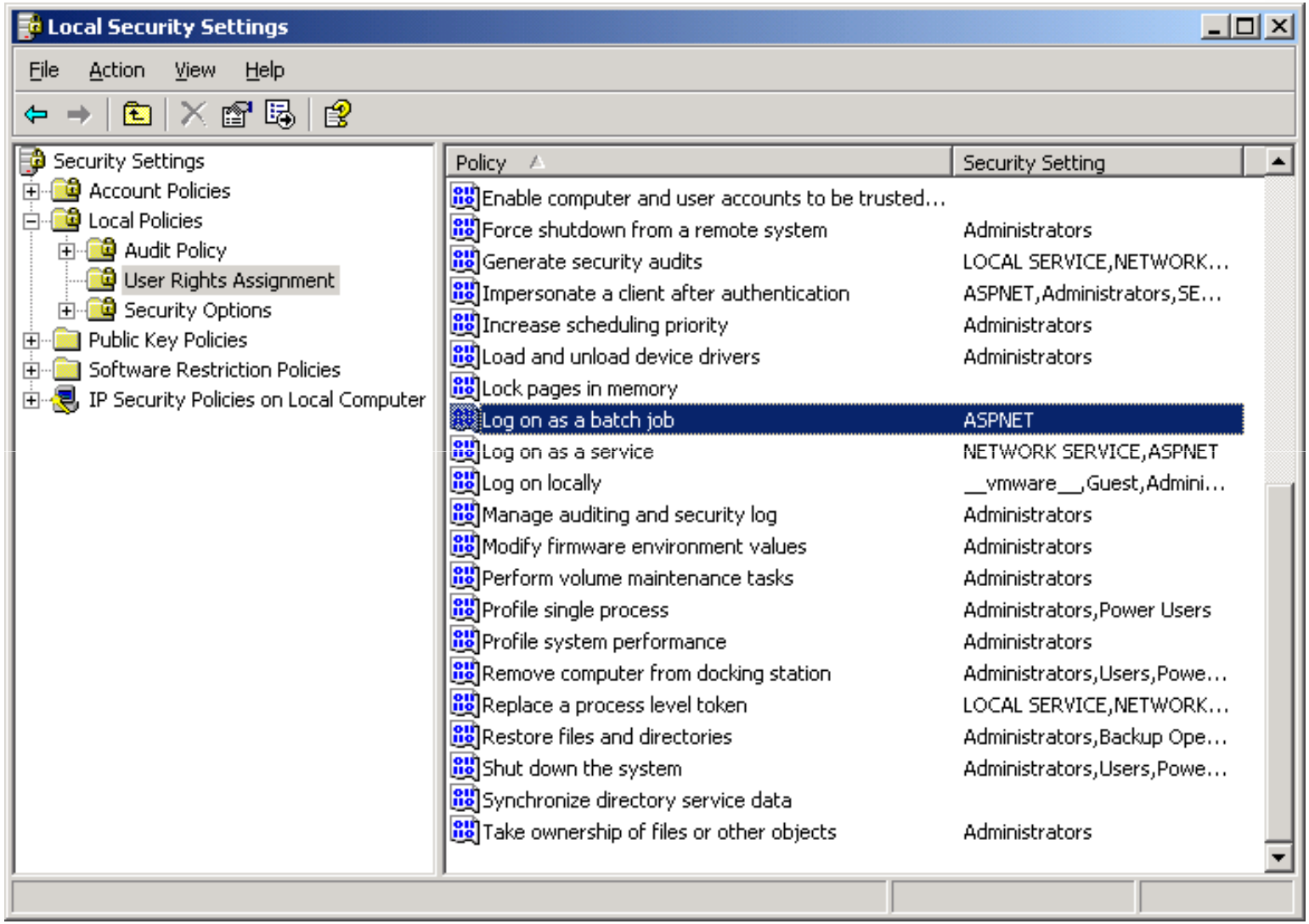
If EM is in use => grant OS user:



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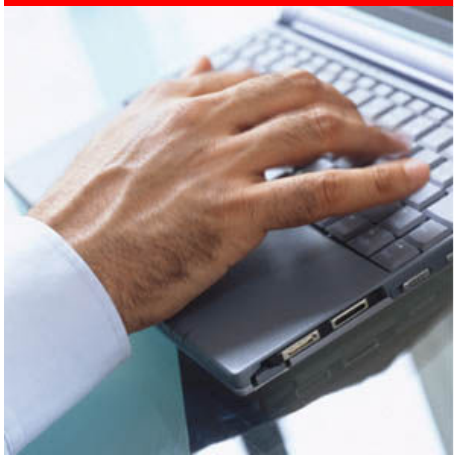
Agenda



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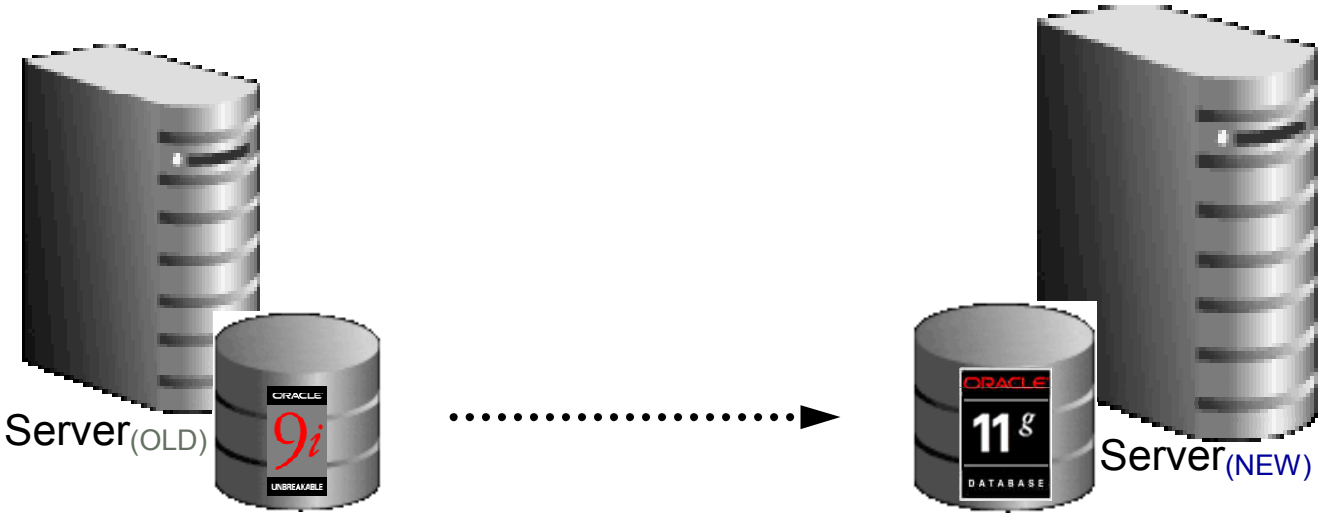
Command Line Upgrade

- Typical scenario: e.g. changing to a new server



1) Install Oracle11g software
2) Copy `utlu112i.sql`
3) Run `utlu112i.sql`
4) Shutdown database
5) Copy all relevant files
   (dbf, ctl, log, spfile, orapw)
6) Apply suggested changes
7) Start the upgrade process

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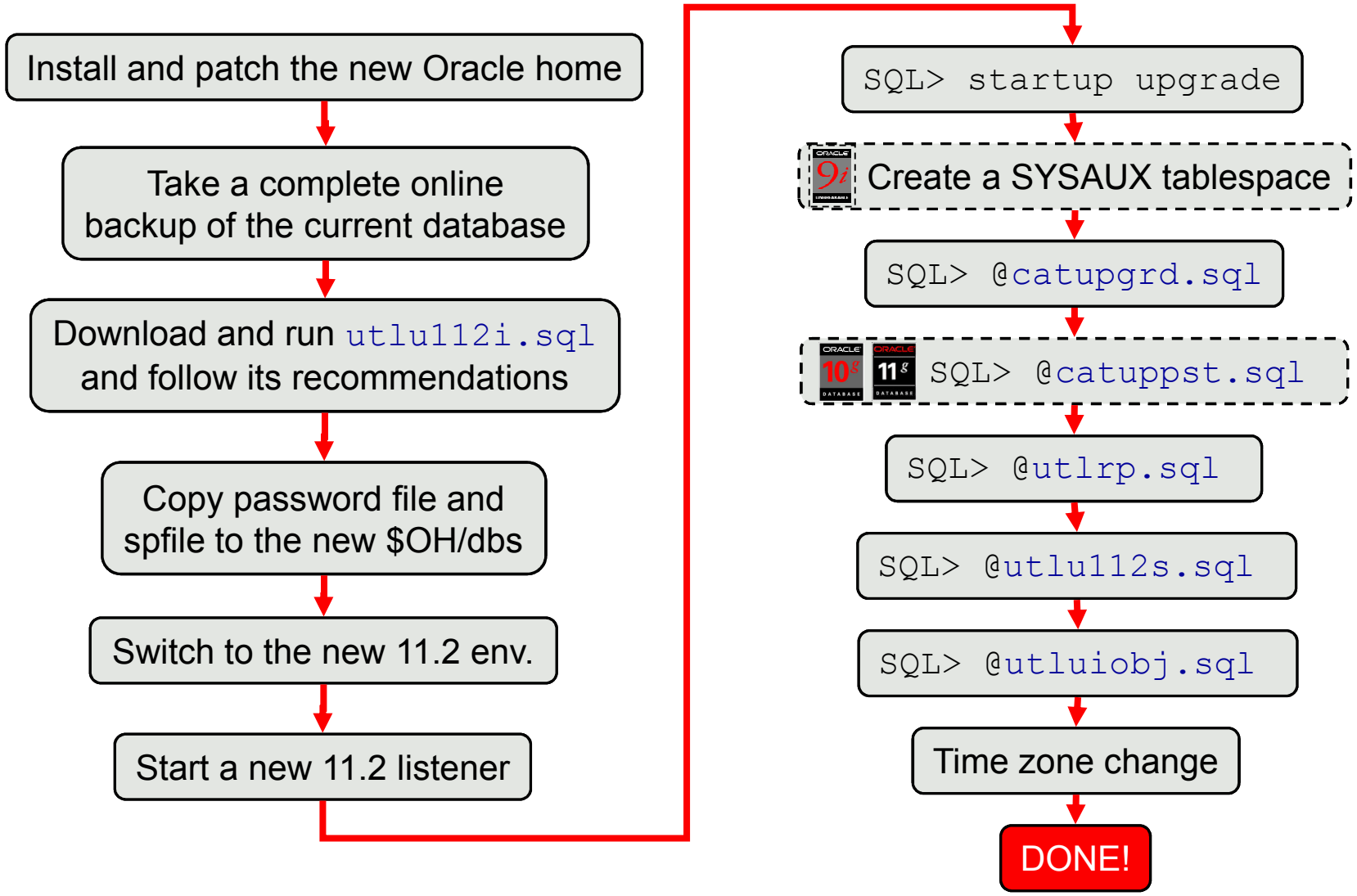
Command Line Upgrade – Step-by-Step



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Command Line Upgrade

- Upgrade information script: **utlu112i.sql**

  - Run in the environment of the source database
  - Checks all init parameters and displays warnings for obsolete and deprecated parameters
  - Checks
    - Components
    - Tablespace SYSAUX
    - Time zone file version check
    - Cluster database check

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Command Line Upgrade

- Get the current version of **utlu*nm*i.sql**
  - Download it now!
  - Note:884522.1

Coming From Version	Script Build/Date	Upgrade Target Version
9.2.0 (9.2.0.8 and above), 10.1.0, 10.2.0, 11.1.0	Build 4 December 2010	11gR2 (11.2.0.2) - utlu112i_2.sql
Use the above script when your target upgrade is 11.2.0.2. If you are planning to upgrade to 11.2.0.1, use the utlu112_1.sql script below.		
9.2.0 (9.2.0.8 and above), 10.1.0, 10.2.0, 11.1.0	Build 4 December 2010	11gR2 (11.2.0.1) - utlu112i_1.sql
9.2.0 (9.2.0.4 and above), 10.1.0,10.2.0	Build 2 December 2010	11gR1- utlu111i.sql
8.1.7, 9.0.1, 9.2.0 (9.2.0.4 and above), 10.1.0	Build 2 December 2010	10gR2 - utlu102i.sql

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Command Line Upgrade

- **utlu112i.sql**: DB info

```
**********************************************************************
Database:
**********************************************************************
--> name:          V9208
--> version:       9.2.0.8.0
--> compatible:    9.2.0
--> blocksize:     8192
--> timezone file: V1
```

1

```
**********************************************************************
Miscellaneous Warnings
**********************************************************************
WARNING: --> Deprecated CONNECT role granted to some user/roles.
.... CONNECT role after upgrade has only CREATE SESSION privilege.
WARNING: --> Database is using a timezone file older than version 11.
.... After the release migration, it is recommended that DBMS_DST package
.... be used to upgrade the 9.2.0.8.0 database timezone version
.... to the latest version which comes with the new release.
```

2

- Time zone conversion should be done after the upgrade has completed
  - Recommended
  - Necessary if datatype `TIMESTAMP WITH TIME ZONE` is used

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Command Line Upgrade

- **utlu112i.sql**: Tablespaces adequate size?

```
**************************************************************************
Tablespaces: [make adjustments in the current environment]
**************************************************************************
WARNING: --> SYSTEM tablespace is not large enough for the upgrade.
.... currently allocated size: 200 MB
.... minimum required size: 287 MB
.... increase current size by: 87 MB
.... tablespace is NOT AUTOEXTEND ENABLED.
WARNING: --> UNDOTBS1 tablespace is not large enough for the upgrade.
.... currently allocated size: 50 MB
.... minimum required size: 470 MB
.... increase current size by: 420 MB
.... tablespace is NOT AUTOEXTEND ENABLED.
--> TEMPTBS tablespace is adequate for the upgrade.
.... minimum required size: 61 MB
```

❸

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Command Line Upgrade

- **utlu112i.sql**: Init parameter changes?

```
**************************************************************************
Update Parameters: [Update Oracle Database 11.2 init.ora or spfile]
Note: Pre-upgrade tool was run on a lower version 32-bit database.
**************************************************************************
--> If Target Oracle is 32-Bit, refer here for Update Parameters:
WARNING: --> "compatible" must be set to at least 10.1.0
WARNING: --> "shared_pool_size" needs to be increased to at least 251 MB
WARNING: --> "db_cache_size" needs to be increased to at least 50331648 bytes
.
--> If Target Oracle is 64-Bit, refer here for Update Parameters:
WARNING: --> "compatible" must be set to at least 10.1.0
WARNING: --> "shared_pool_size" needs to be increased to at least 487 MB
WARNING: --> "db_cache_size" needs to be increased to at least 50331648 bytes
.
**************************************************************************
Renamed Parameters: [Update Oracle Database 11.2 init.ora or spfile]
**************************************************************************
WARNING: --> "db_block_buffers" new name is "db_cache_size" new value is "16384000"
.
**************************************************************************
Obsolete/Deprecated Parameters: [Update Oracle Database 11.2 init.ora or spfile]
**************************************************************************
--> background_dump_dest         11.1       DEPRECATED   replaced by  "diagnostic_dest"
--> user_dump_dest               11.1       DEPRECATED   replaced by  "diagnostic_dest"
```

4

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Command Line Upgrade

- **utlu112i.sql**: Components and options?

```
**************************************************************************
5 Components: [The following database components will be upgraded or installed]
**************************************************************************
--> Oracle Catalog Views          [upgrade]  VALID
--> Oracle Packages and Types     [upgrade]  VALID
--> JServer JAVA Virtual Machine  [upgrade]  VALID
--> Oracle XDK for Java           [upgrade]  VALID
--> Oracle XML Database           [upgrade]  VALID
--> Oracle Java Packages          [upgrade]  VALID
```

- Annotation:
  You'll have to install all options installed for the release you are upgrading from – otherwise some components can't be upgraded

- To remove (or reinstall) components manually:
  Note:472937.1 Information On Installed Database Components and Schemas
  Note.300056.1 Debug and Validate Invalid Objects
  Note:753041.1 How to diagnose Components with NON VALID status
  Note.733667.1 How to Determine if XDB is Being Used in the Database?

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Command Line Upgrade

- **utlu112i.sql**: Materialized Views Refresh?
  - `WARNING: --> There are materialized view refreshes in progress.`
    `.... Ensure all materialized view refreshes are complete prior to upgrade.`
  - Below query should return "No rows" when you start the upgrade process – otherwise wait for MV refreshes to be completed

```
SELECT * FROM sys.obj$ o, sys.user$ u, sys.sum$ s
 WHERE o.obj# = s.obj# AND o.owner# = u.user#
   AND o.type# = 42 AND bitand(s.mflags, 8) = 8;
```

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Command Line Upgrade

- Create Dictionary statistics
- Shutdown the database (**`IMMEDIATE/NORMAL`**)
- Adjust init parameters:
  - COMPATIBLE ≥ 10.1.0
  - SGA_TARGET ≥ 524MB (32-bit) ... ≥ 748MB (64-bit)
  - PGA_AGGREGATE_TARGET ≥ 25MB
  - LOG_ARCHIVE_FORMAT must contain %s, %t and %r
- Move init.ora/SPFILE and PWDsid.ora to their new location
- Start a new 11*g*-Listener *(use the NETCA or copy tns files)*
- Change environment to point to the new $ORACLE_HOME

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Command Line Upgrade

- Windows only:
  - Delete the old Service:

```
> oradim -DELETE -SID ORCL
```

  - Create a new Service:

```
> oradim -NEW
  -SID ORCL
  -SYSPWD passwrd
  -STARTMODE a
  -PFILE initfile
```

ORADIM creates a logfile in %ORACLE_HOME%\database

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Command Line Upgrade

```
SQL> STARTUP UPGRADE;
```

```
ALTER SYSTEM SET _system_trig_enabled=FALSE SCOPE=MEMORY;
Autotune of undo retention is turned off.
ALTER SYSTEM SET _undo_autotune=FALSE SCOPE=MEMORY;
ALTER SYSTEM SET undo_retention=900 SCOPE=MEMORY;
ALTER SYSTEM SET aq_tm_processes=0 SCOPE=MEMORY;
ALTER SYSTEM SET enable_ddl_logging=FALSE SCOPE=MEMORY;
Resource Manager disabled during database migration: plan '' not set
ALTER SYSTEM SET resource_manager_plan='' SCOPE=MEMORY;
ALTER SYSTEM SET recyclebin='OFF' DEFERRED SCOPE=MEMORY;
Resource Manager disabled during database migration
```

Please note:This is an excerpt from the alert.log – these parameters will be set implicitely during a STARTUP UPGRADE

- Supresses unnecessary error messages like **`ORA-00942: table or view does not exist`**- thus logfiles will be easier to read and check

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Command Line Upgrade

- Create tablespace SYSAUX (only if source is a 9*i* db) :

```
SQL> CREATE TABLESPACE SYSAUX
     DATAFILE 'file' SIZE 500M
     AUTOEXTEND ON MAXSIZE 8G
     EXTENT MANAGEMENT LOCAL
     SEGMENT SPACE MANAGEMENT AUTO
     ONLINE;
```


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Command Line Upgrade

- One upgrade script for all releases and all components:

```
SQL> @catupgrd.sql
```

  - Useful:

```
SQL> set echo on
SQL> SPOOL c:\temp\upgrade.log
```

  - Database will be shutdown when script has been completed

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Command Line Upgrade

- Post upgrade script: **`catuppst.sql`**
  - Only necessary when upgrading from ≥10.1
  - Located in `?/rdbms/admin`
  - Runs when database is started up in `normal` mode
  - Will update the following information:
    - Upgrade Automatic Workload repository (AWR) baseline information
    - Upgrade ADDM task metadata
    - Update Oracle Label security (OLS) policies
  - Invokes catbundle.sql automatically

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Command Line Upgrade

Best Practice

- Generate fixed object stats:

```
SQL> exec DBMS_STATS.GATHER_FIXED_OBJECT_STATS;
```

  - Just best practice at this stage to run the next step more efficient
  - See Note:798257.1 for more detailled information on gathering fixed object statistics

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Command Line Upgrade

- Recompilation:
  - **`utlrp.sql`**
    - Calls **`utlprp.sql`** and determines the parallel degree for recompilation based on CPU cores
    - Recompiles all INVALID objects
    - Utilizes package **`utl_recomp`**
    - Re-enables functional indexes automatically
    - **`utlprp.sql`** can be called directly like:
      - **`SQL> @utlprp 7`**
      - This can be useful to minimize CPU usage

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Command Line Upgrade

Best Practice

- Monitor the progress during recompilation :

1. Query returning the number of invalid objects remaining.
   This number should decrease with time.

```
SELECT COUNT(*) FROM obj$ WHERE status IN (4, 5, 6);
```

2. Query returning the number of objects compiled so far.
   This number should increase with time.

```
SELECT COUNT(*) FROM UTL_RECOMP_COMPILED;
```

3. Query showing jobs created by UTL_RECOMP.

```
SELECT job_name FROM dba_scheduler_jobs
 WHERE job_name like 'UTL_RECOMP_SLAVE_%';
```

4. Query showing UTL_RECOMP jobs that are running.

```
SELECT job_name FROM dba_scheduler_running_jobs
 WHERE job_name like 'UTL_RECOMP_SLAVE_%';
```

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Command Line Upgrade

- Post upgrade script: **utlu112s.sql**
  - Run against new database in 11*g* environment
  - Checks the upgrade results according to **DBA_REGISTRY**
  - Displays duration of the upgrade per component and in total

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Command Line Upgrade

- Post upgrade script: **utlu112s.sql**

```
SQL> @?/rdbms/admin/utlu112s.sql
Oracle Database 11.2 Post-Upgrade Status Tool         10-07-2009 11:48:30
Component                                Status         Version  HH:MM:SS
Oracle Server                             VALID      11.2.0.1.0  00:24:32
JServer JAVA Virtual Machine              VALID      11.2.0.1.0  00:06:10
Oracle Workspace Manager                  VALID      11.2.0.1.0  00:01:11
OLAP Analytic Workspace                   VALID      11.2.0.1.0  00:00:44
OLAP Catalog                              VALID      11.2.0.1.0  00:01:33
Oracle OLAP API                           VALID      11.2.0.1.0  00:00:58
Oracle Enterprise Manager                 VALID      11.2.0.1.0  00:15:19
Oracle XDK                                VALID      11.2.0.1.0  00:06:11
Oracle Text                               VALID      11.2.0.1.0  00:01:18
Oracle XML Database                       VALID      11.2.0.1.0  00:07:43
Oracle Database Java Packages             VALID      11.2.0.1.0  00:00:42
Oracle Multimedia                         VALID      11.2.0.1.0  00:09:57
Spatial                                   VALID      11.2.0.1.0  00:10:34
Oracle Expression Filter                  VALID      11.2.0.1.0  00:00:23
Oracle Rules Manager                      VALID      11.2.0.1.0  00:00:20
Gathering Statistics                                             00:11:31

Total Upgrade Time: 01:39:16
```

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Command Line Upgrade

- Compare invalid objects script: **utluiobj.sql**

```
SQL> @?/rdbms/admin/utluiobj.sql

Oracle Database 11.1 Post-Upgrade Invalid Objects Tool 08-03-2010 18:23:09

This tool lists post-upgrade invalid objects that were not invalid
prior to upgrade (it ignores pre-existing pre-upgrade invalid objects).

Owner                          Object Name                          Object Type
...
```

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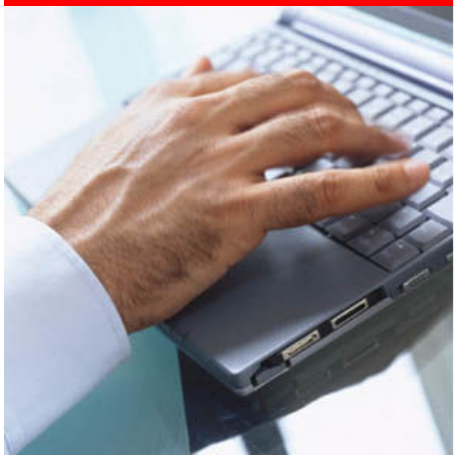
Agenda



- Preparation
- Installation
- Upgrade
  - Database Upgrade Assistant
  - Command Line Upgrade
  - Post Upgrade
  - Alternatives
  - Migration
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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Post Upgrade - SPFILE

Best Practice

- Always create an editable init.ora from the current SPFILE after the upgrade has been finished
- Prevents rewrite in case of setting wrong parameters or forced edit
- Keep in mind:
  - The SPFILE is binary file!!! Don't edit it!! Default since Oracle 9.0
  - It simply will exist after using DBUA or DBCA

```
SQL> create pfile='/tmp/initDB.ora' from spfile;
<< Now edit init.ora with any editor >>
SQL> startup force pfile=/tmp/initDB.ora
SQL> create spfile from pfile;
```

  - Parameter can be changed by:

```
SQL> alter system set PARAMETER=VALUE scope=both;
```

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Post Upgrade Task – time zone

Only in 11*g* Release 2

- Adjust time zone data in the database to DST V11 or higher:

```
startup upgrade
exec dbms_dst.begin_upgrade(new_version => 14);
shutdown immediate;

startup;
set serveroutput on;
declare
 num_of_failures number;
begin
 dbms_dst.upgrade_database(num_of_failures);
 dbms_output.put_line(num_of_failures);
 dbms_dst.end_upgrade(num_of_failures);
 dbms_output.put_line(num_of_failures);
end;
/
```

- For more information see the Globalization Doc:
  http://download.oracle.com/docs/cd/E11882_01/server.112/e10729/ch4datetime.htm#NLSPG261

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Network ACLs

- Oracle XML DB must be installed (default!) if one or more of these packges are used:
  `UTL_TCP, UTL_SMTP, UTL_MAIL, UTL_HTTP` and/or `UTL_INADDR`
- See Note:453786.1 for further explanation
- See also the Database Upgrade Guide for an example:
  http://download.oracle.com/docs/cd/E11882_01/server.112/e17222/upgrade.htm#sthref148

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Gather Workload Statistics

Best Practice

- Gather system statistics during a regular workload period - otherwise non-appropriate values for the CBO will be used:

```
SQL> EXECUTE dbms_stats.gather_system_stats('start');
   << Run it for several hours on a workload – does not generate overhead!!! >>
SQL> EXECUTE dbms_stats.gather_system_stats('stop');
```

```
SQL> select pname NAME, pval1 VALUE, pval2 INFO
     from aux_stats$;

NAME                      VALUE INFO
------------------- ---------- ------------------------------
STATUS                          COMPLETED
DSTART                          04-03-2010 12:30
DSTOP                           05-03-2010 12:30
FLAGS                        1
CPUSPEEDNW            2498,65
IOSEEKTIM              11,405
IOTFRSPEED           25595,605
...
```


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Gather Workload Statistics

INFO

- Calibrate I/O (Orion): Example

```
SET SERVEROUTPUT ON
DECLARE lat INTEGER;
iops INTEGER;
mbps INTEGER;
BEGIN
DBMS_RESOURCE_MANAGER.CALIBRATE_IO (28, 10, iops, mbps, lat);
DBMS_OUTPUT.PUT_LINE ('max_iops = ' || iops);
DBMS_OUTPUT.PUT_LINE ('latency = ' || lat);
DBMS_OUTPUT.PUT_LINE('max_mbps = ' || mbps);
end;
/
```

  - *This is a requirement for AUTODOP (automatic degree of parallelism in 11.2.0.2) – in addtition PARALLEL_DEGREE_POLICY must be set to AUTO*

- Delete system stats and revert to the default values:

```
SQL> EXECUTE dbms_stats.delete_system_stats;
```

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Workload Stats: Further Information

- See the **Performance Tuning Guide** for all stats:
  - http://download.oracle.com/docs/cd/E11882_01/server.112/e16638/stats.htm#PFGRF94743
  - See also:
  - 13.4.1.2 Multiblock Read Count

    If you gather workload statistics, then the `mbrc` value gathered as part of the workload statistics is used to estimate the cost of a full table scan. However, during the gathering process of workload statistics, Oracle Database may not gather the `mbrc` and `mreadtim` values if no table scans are performed during serial workloads, as is often the case with OLTP systems. However, full table scans occur frequently on DSS systems but may run parallel and bypass the buffer cache. In such cases, Oracle Database still gathers the `sreadtim` value because the database performs index lookup using the buffer cache.
  - If Oracle Database cannot gather or validate gathered `mbrc` or `mreadtim` values, but has gathered `sreadtim` and `cpuspeed` values, then the database uses only the `sreadtim` and `cpuspeed` values for costing. In this case, the optimizer uses the value of the initialization parameter `DB_FILE_MULTIBLOCK_READ_COUNT` to cost a full table scan. However, if `DB_FILE_MULTIBLOCK_READ_COUNT` is not set or is set to `0` (zero), then the optimizer uses a value of `8` for costing.

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Post Upgrade: Fixed Table Stats

Best Practice

- Create fixed table statistics directly after catupgrd.sql has been completed:

```
SQL> exec DBMS_STATS.GATHER_FIXED_OBJECT_STATS;
```

  - Otherwise it can happen that MMON will cause too much CPU load

  - Create fixed table statistics again after a week with regular production workload
  - This task should be done only a few times per year

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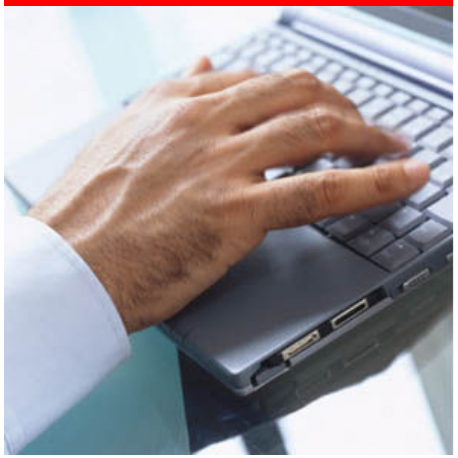
Agenda



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Upgrade Alternatives

- Migration methods
- Minimal downtime methods
  - What does "minimal downtime" really mean?
    - 12 hours?
    - 60 minutes?
    - 5 minutes?
    - Less?
    - No downtime at all?

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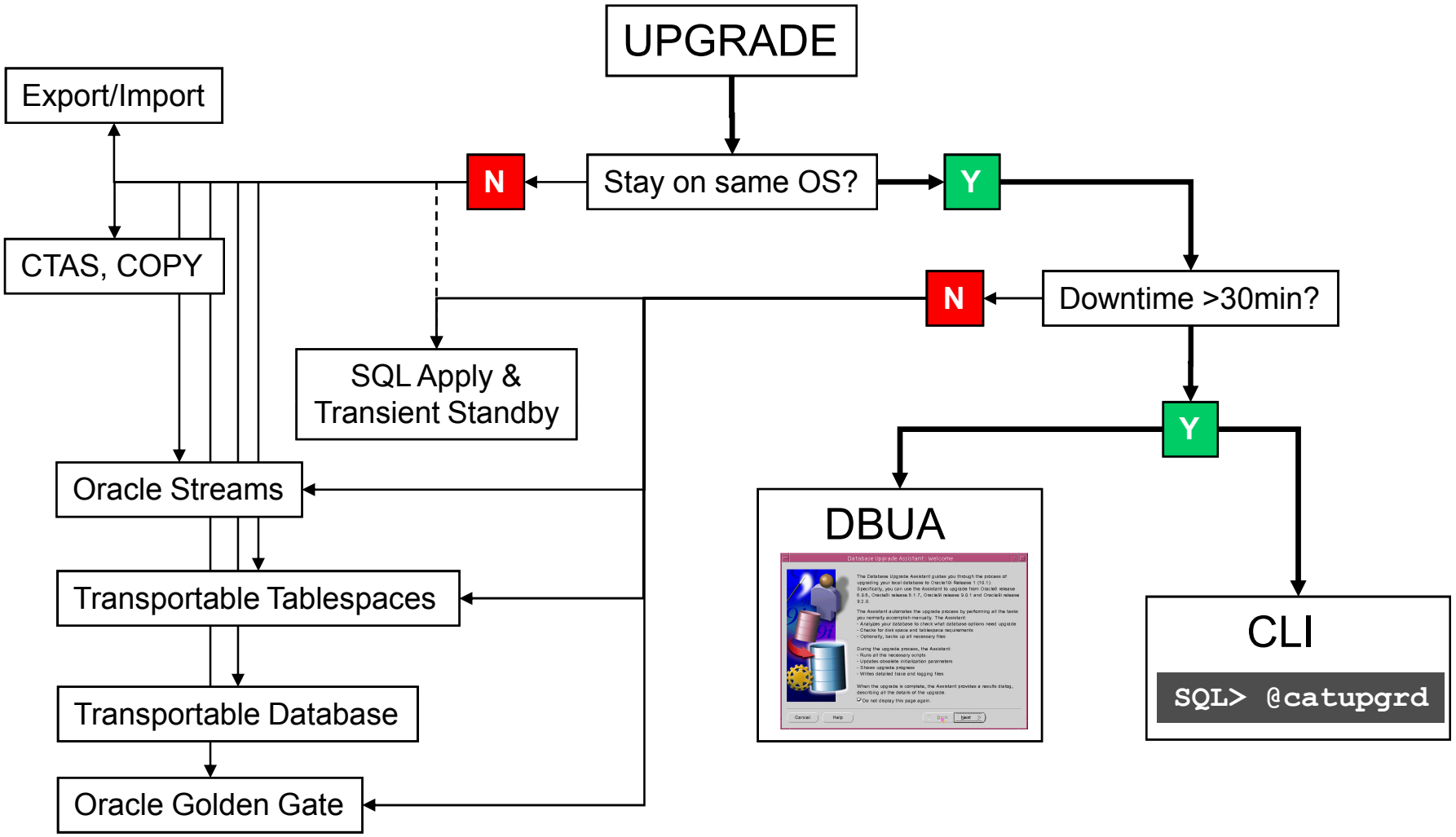
Upgrade Paths



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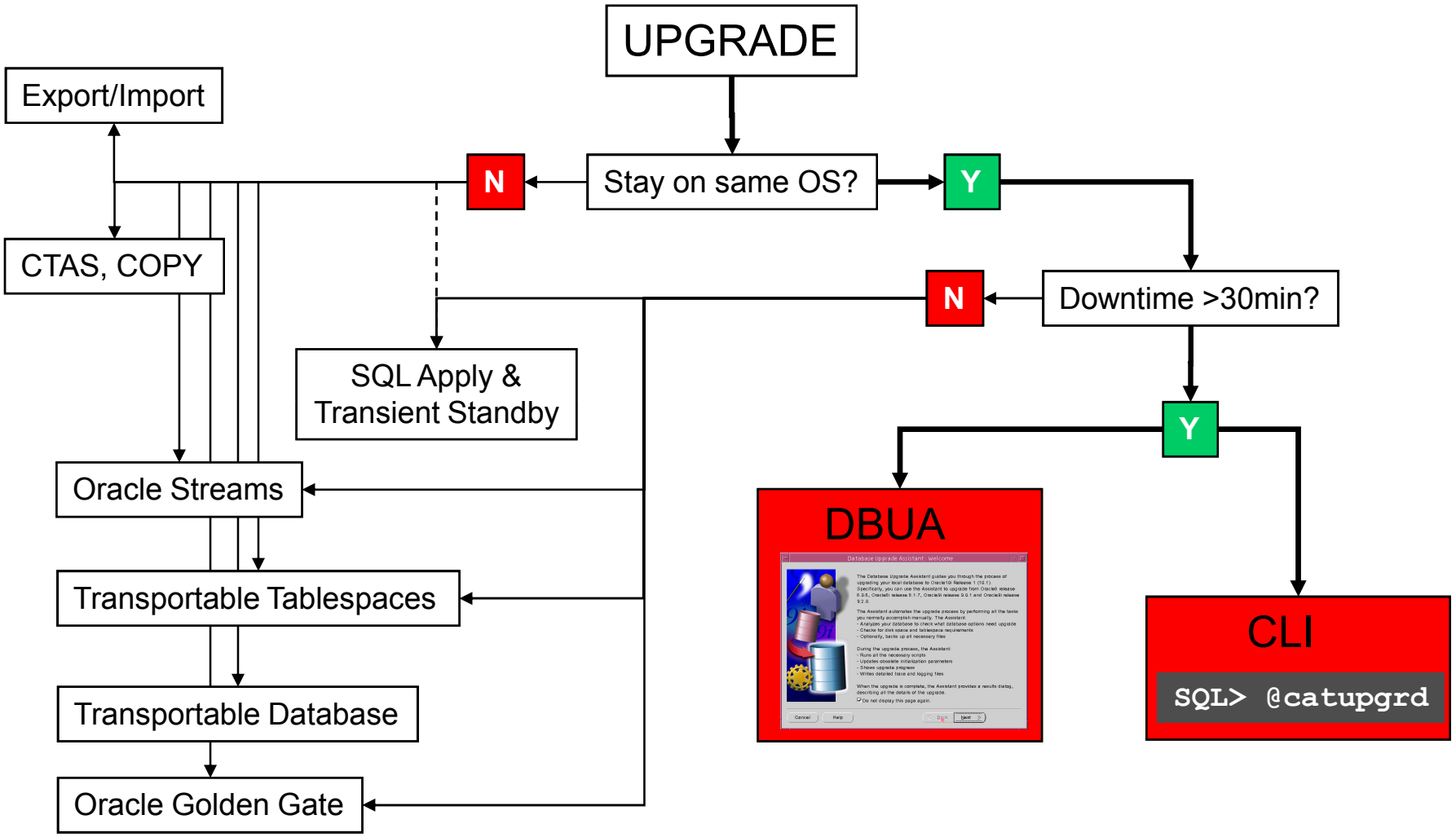
Upgrade Paths



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"Regular" Database Upgrade

- Upgrade duration is mainly dependent on the number of installed components
  - Completes usually in 20-90 minutes
    - No difference between DBUA and command line upgrade
  - This is not a recommendation to deinstall any components!!!

Component	HH:MM:SS
Oracle Server	00:16:17
JServer JAVA Virtual Machine	00:05:19
Oracle Workspace Manager	00:01:01
Oracle Enterprise Manager	00:10:13
Oracle XDK	00:00:48
Oracle Text	00:00:58
Oracle XML Database	00:04:09
Oracle Database Java Packages	00:00:33
Oracle Multimedia	00:07:43
Oracle Expression Filter	00:00:18
Oracle Rule Manager	00:00:12
Gathering Statistics	00:04:53

Total Upgrade Time: 00:52:31

Component	HH:MM:SS
Oracle Server	00:16:17
JServer JAVA Virtual Machine	00:05:19
Oracle XDK	00:00:48
Oracle Text	00:00:58
Oracle XML Database	00:04:09
Oracle Database Java Packages	00:00:33
Gathering Statistics	00:02:43

Total Upgrade Time: 00:30:47

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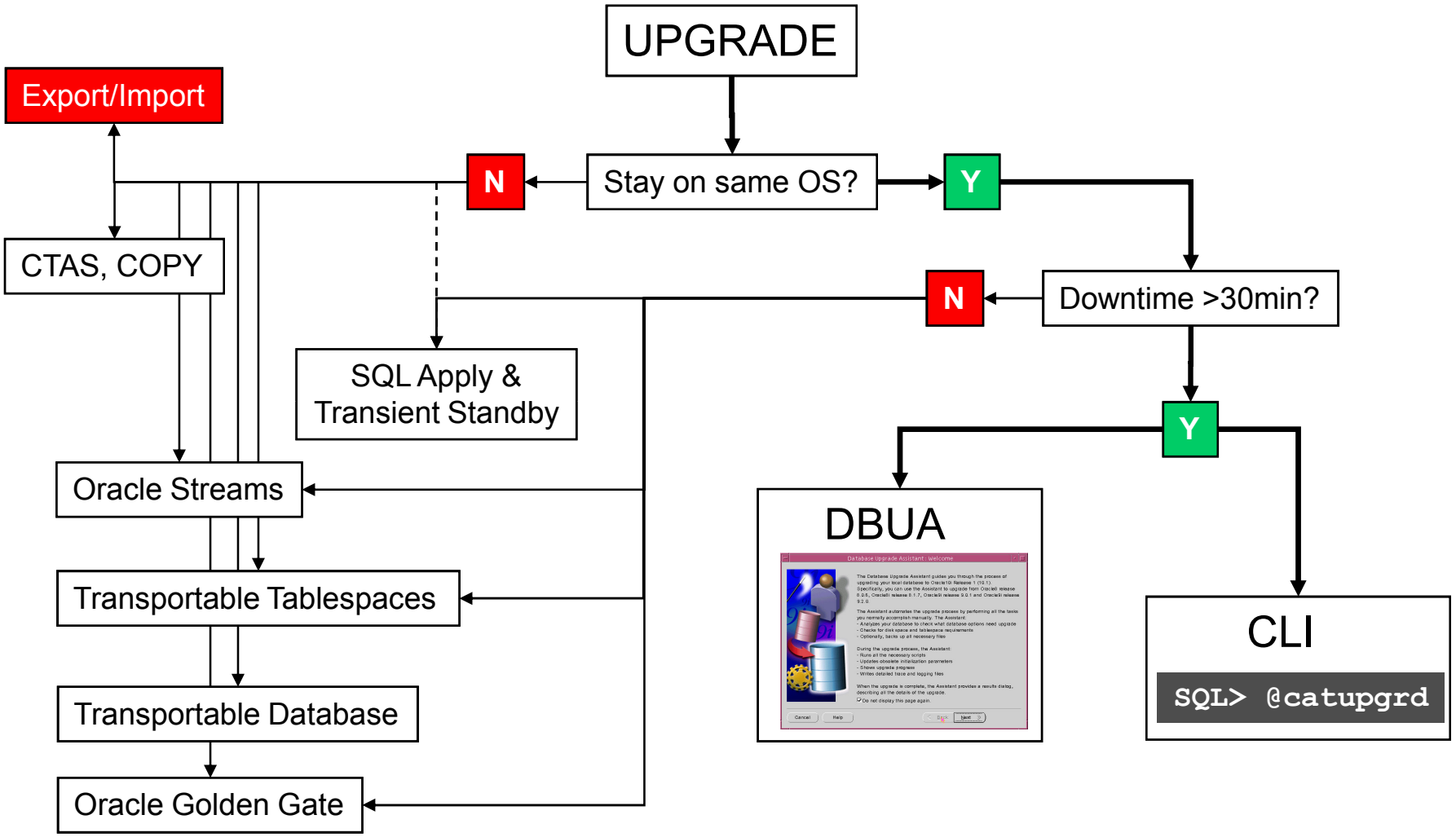
Upgrade Paths



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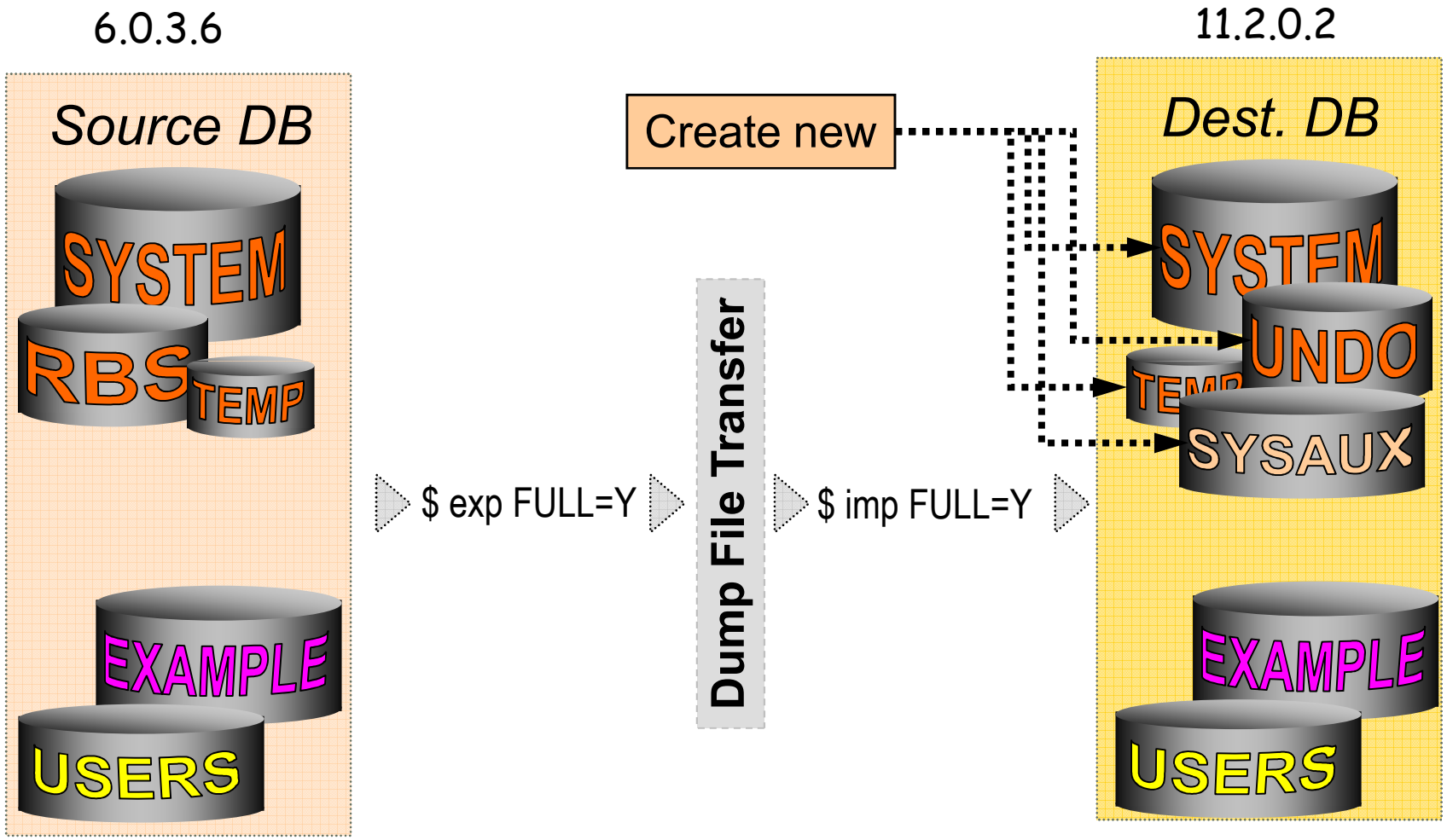
Export - Import



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Export - Import

- All purpose
- Import of all versions ≥ Oracle V5 possible
- "exp" is *not supported* in 11*g* anymore
  - But the utility is still there and can be used
  - "imp" is still supported for importing older dumpfiles
- Not really fast but well known and reliable
  - Relation between amount of data and runtime
- Necessary and helpful :
  - Changing the database charactersets
  - Changing the OS platform
  - Schema consolidation
  - Non-direct-upgrade supported releases such as 8.0.3
- No need to care for source patch release or time zone patches

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Export - Import

- Export/Import
  - Changing the character set
    - Changing the Database Character Set
      Note:225912.1
    - Use Scanner Utility CSscan before altering the DB Character set
      Note:123670.1
    - Unicode
      - Problem can be special characters, e.g.:
        Umlaut Ä in WE8ISO... = 1 Byte
        Umlaut Ä in UTF8 = 2 Byte
        - Workaround: `nls_length_semantics=char`
      - Important Unicode Notes on support.oracle.com:
        Note:260893.1 and Note:788156.1
    - WE8ISO8859P1 ==> P15: Note:257722.1
  - Character Set Migration - Resources:
    - http://www.oracle.com/technetwork/database/features/globalization/index.html

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Export - Import

- Hints and tricks
  - Transfer dump files always in **`BINARY`** mode
  - Do full database export always as user **`SYSTEM`**
    - GRANTs on SYS's objects have to be exported separately
  - Import takes approximately 3x times as long as Export
  - Export always with the lowest involved database version
  - Import always with **`imp`** of target database
    - See also: Note:286775.1
  - Export performance
    - DIRECT=Y ... bypasses SQL-Layer, but no conversions!
    - Parallelize export by dividing into logical independent chunks of data
  - Import performance
    - Increase BUFFER
    - INDEXES=N ... build indexes later in parallel ... INDEXFILE=...
    - Parameter `COMMIT_WRITE=NOWAIT` (10g) or `COMMIT_WAIT=NOWAIT` (11g) during import

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Data Pump

- The "new" `exp/imp` - since Oracle Database 10*g*
  - Faster than `exp/imp`
  - Powerful concept and more capabilities than exp/imp
    - EXCLUDE
      For examples see Note:341733.1
    - COMPRESS=ALL *(Advanced Compression Option ☺)*
    - SQL with WHERE clause

    - Hint: Use EXCLUDE=STATISTICS while importing
  - Compatibility and version changes: Note:553337.1

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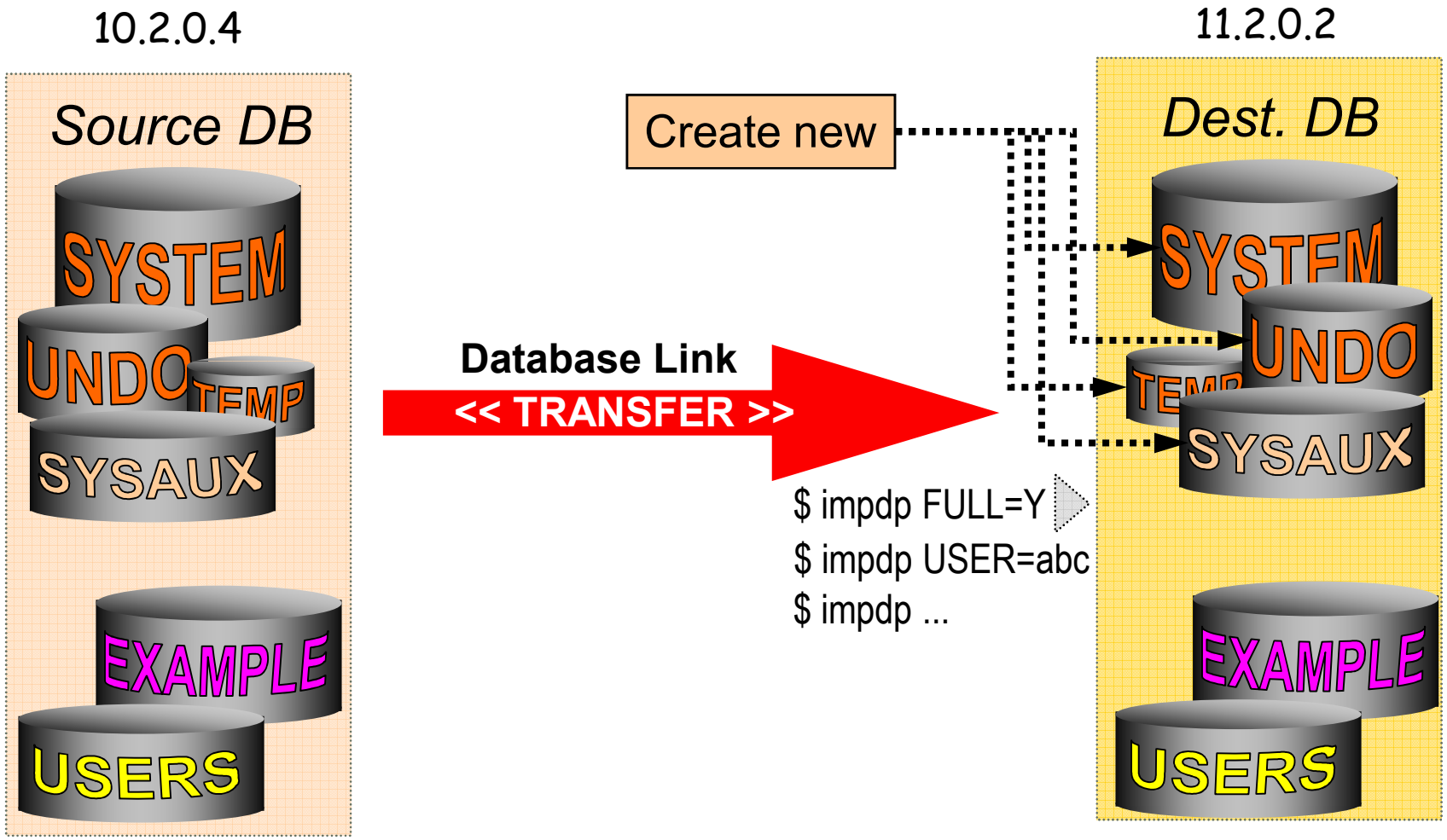
Data Pump with NETWORK_LINK



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Data Pump

- Data Pump using a database link
  - Parameter: NETWORK_LINK
  - Run only `impdp` on the target system
  - No `expdp` necessary
    - Does not work with LONG/LONG RAW and object types
    - No disk-IO and no dump file transfer will be performed
  - Limitation: network bandwidth
  - Example:

```
$ impdp system/pw NETWORK_LINK=mydblink FULL=Y
```

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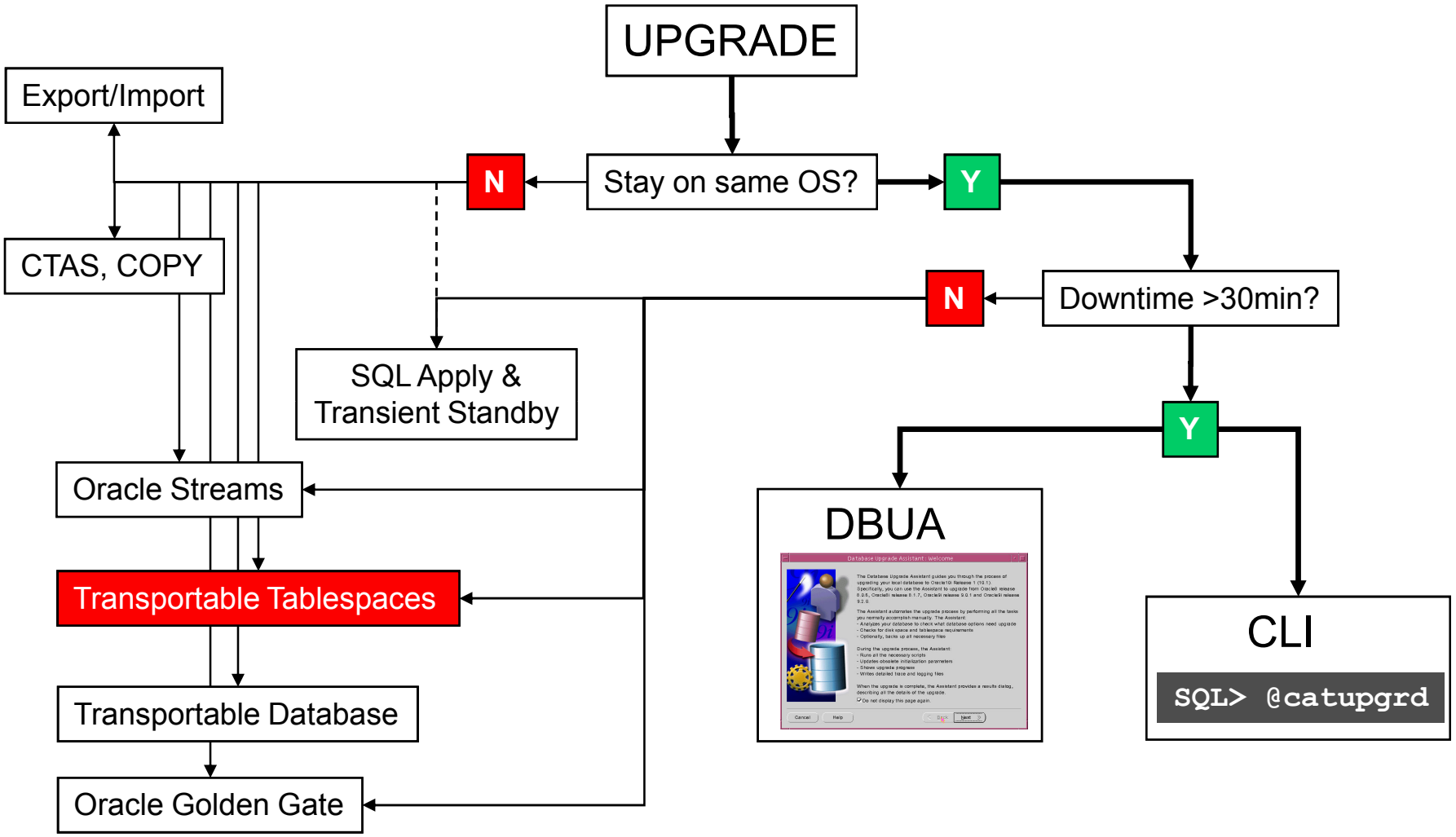
Upgrade Paths



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Transportable Tablespaces

- Concept:
  - Create an "empty" database in the new environment
  - Plug in all data tablespaces from source to target database
    - SYSTEM+SYSAUX tablespaces can't be transported
    - Additional steps necessary to move views, synonyms etc.
  - "Possibly" very fast upgrade
  - Complexity could be constraining
  - Works cross-platform and cross-Endianness since Oracle Database 10*g*

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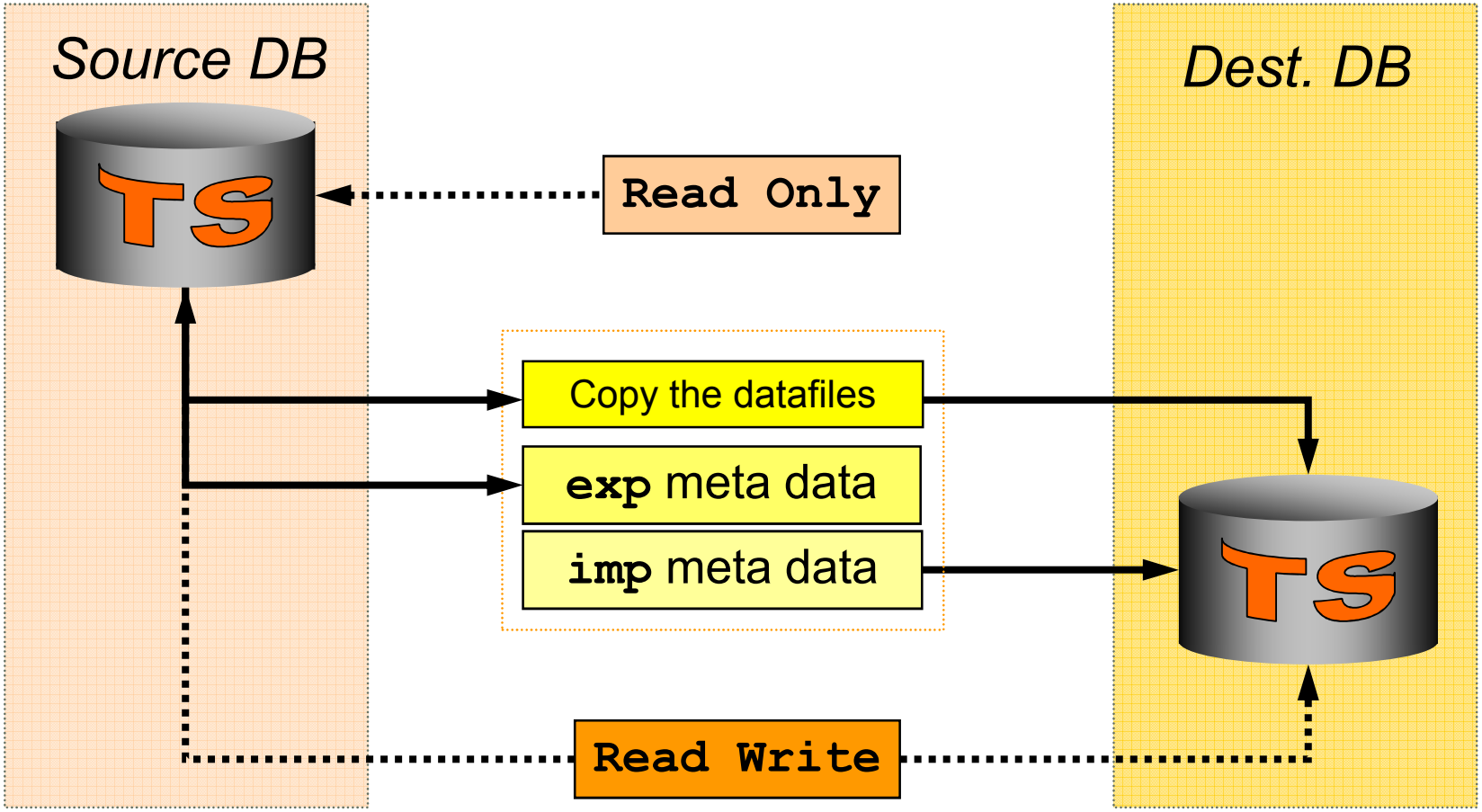
Transportable Tablespaces

- General facts regarding TTS
  - Feature available since Oracle 8*i*



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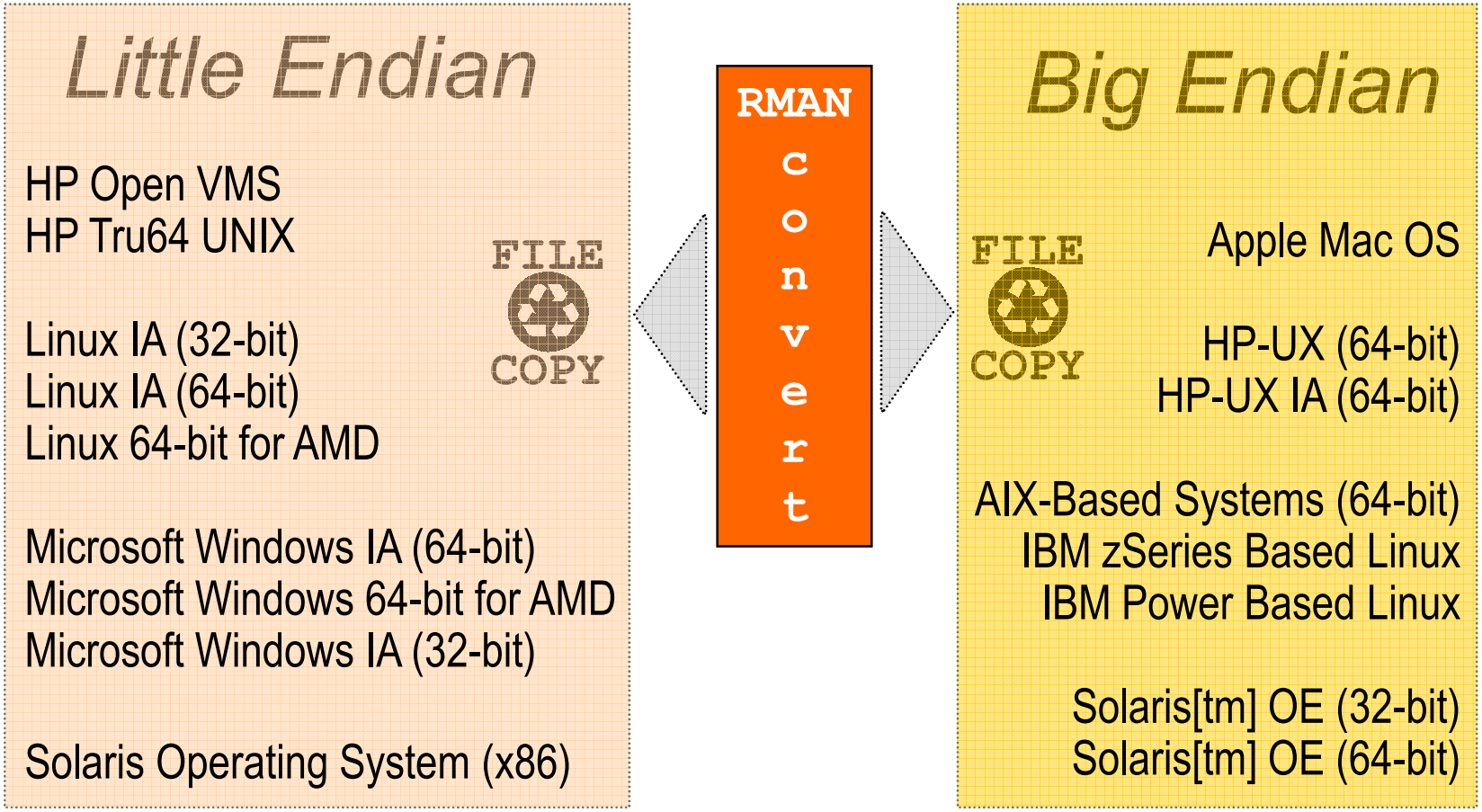
Transportable Tablespaces

- TTS x-platform (v$transportable_platform):



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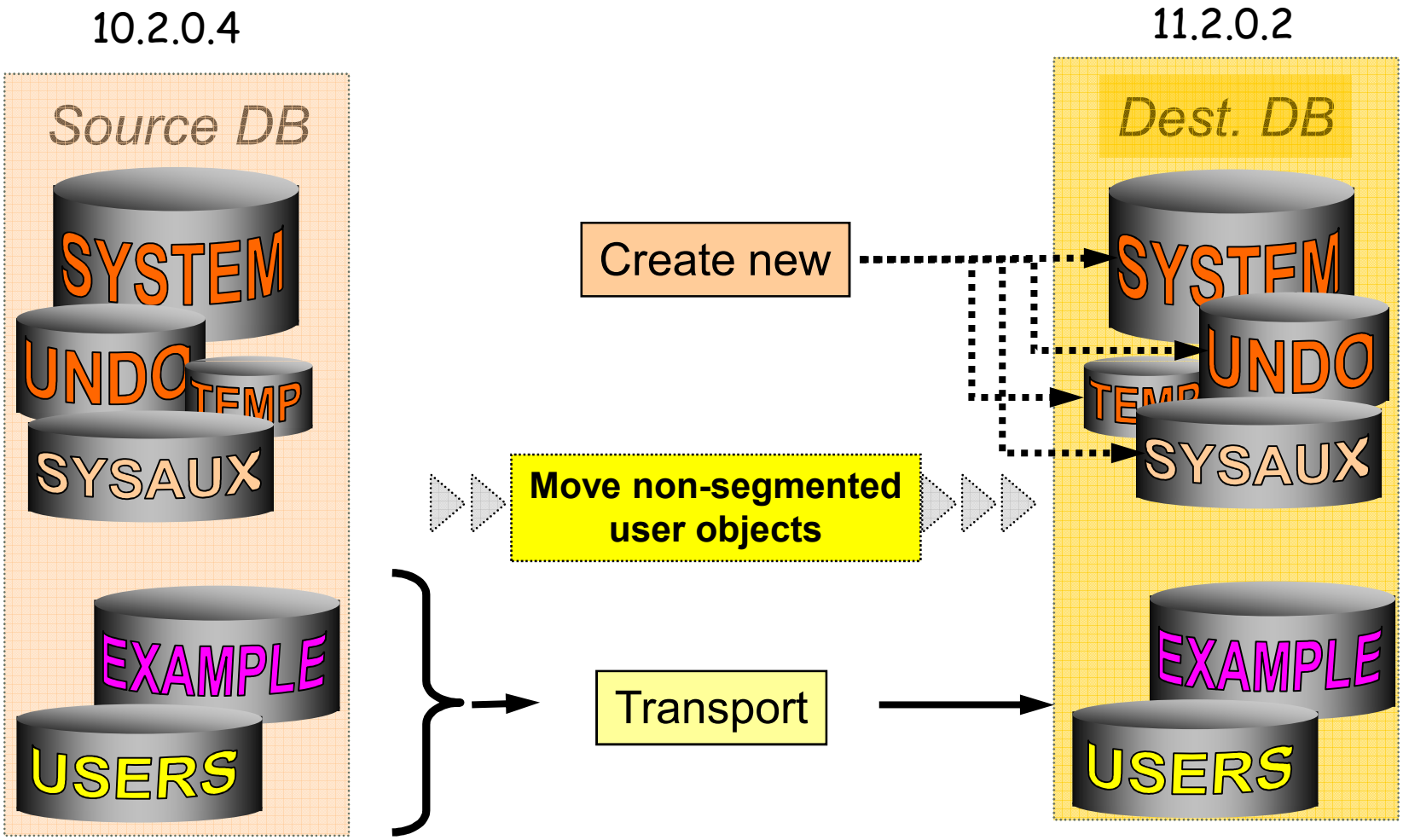
Transportable Tablespaces



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Upgrade Alternatives

- Transportable Tablespaces - 3 ways
  - The "brutal" way
    - Full exp/imp with ROWS=N
  - The "smart" way
    - Generate scripts
      - String concatenation with || ...
      - DBMS_METADATA
  - The "very smart" way
    - RMAN clone with SKIP TABLESPACES option
  - BUT: Be very careful with sequences!!

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Transportable Tablespaces

- Tips & Tricks
  - Talk as early as possible to the application development if TTS will be your upgrade strategy
    - Less complex design is the requirement for fast TTS
  - Use a Physical Standby as transport system
    - Fallback possibility to the old system
  - If you don't move datafiles:
    - Tablespaces can be mounted from both databases simultaneously as long as they are READ ONLY
    - As soon as a tablespace will be set READ WRITE on one database it'll be "lost" for the other one
  - Make sure source and target database have **EQUAL TIME ZONE definitions**
    - If TZsource=V11 then patch TZtarget to V11 first

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Upgrade Alternatives

- Transportable Tablespaces - Information
  - For TTS White Papers see the MAA webpage:
    http://www.oracle.com/technetwork/database/features/availability/oracle-database-maa-best-practices-155386.html
  - Database Upgrades using TTS:
    http://www.oracle.com/technetwork/database/features/availability/maa-wp-11g-upgradetts-132620.pdf
  - Platform Migration using Transportable Database (RMAN):
    http://www.oracle.com/technetwork/database/features/availability/maa-wp-10gr2-platformmigrationtdb-131164.pdf
  - Customer example:
    - Amadeus Customer Case
      http://www.oracle.com/technetwork/database/features/availability/s281209-amadeus-130978.pdf

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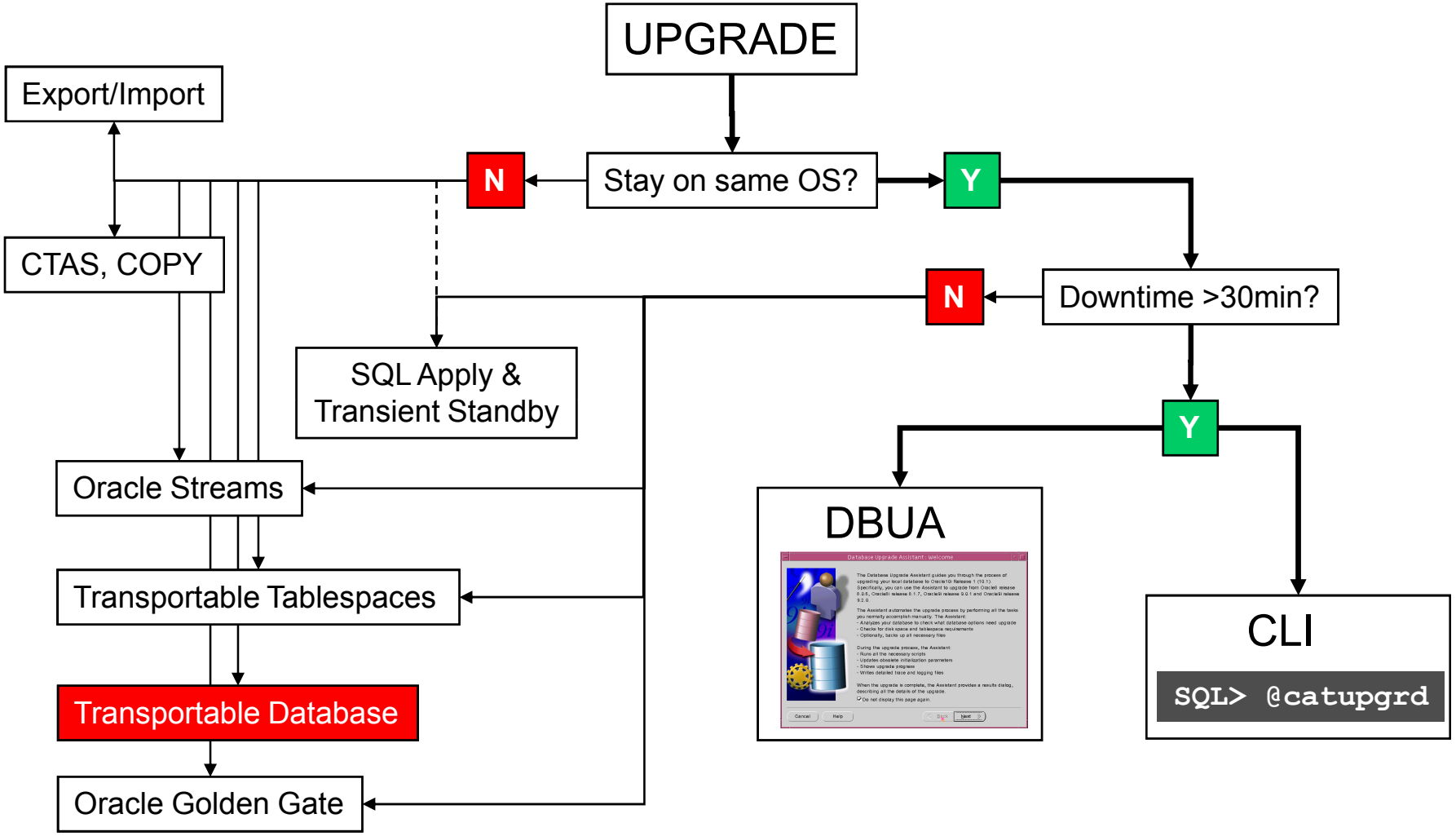
Upgrade Paths



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Transportable Database

- Feature since Oracle Database 10*g* Release 2
  - Cross-platform
  - Unfortunately not cross-Endianness!!!
  - With RMAN in an automated way
    - Database must be switched to READ ONLY mode
  - Datafiles must be converted with RMAN into target format
    - RMAN `CONVERT DATABASE` command
    - Either on the source or the target system – in most cases completes faster on the target system
  - Not a real minimal downtime concept
    - But very comfortable for migrations in between one Endianness group

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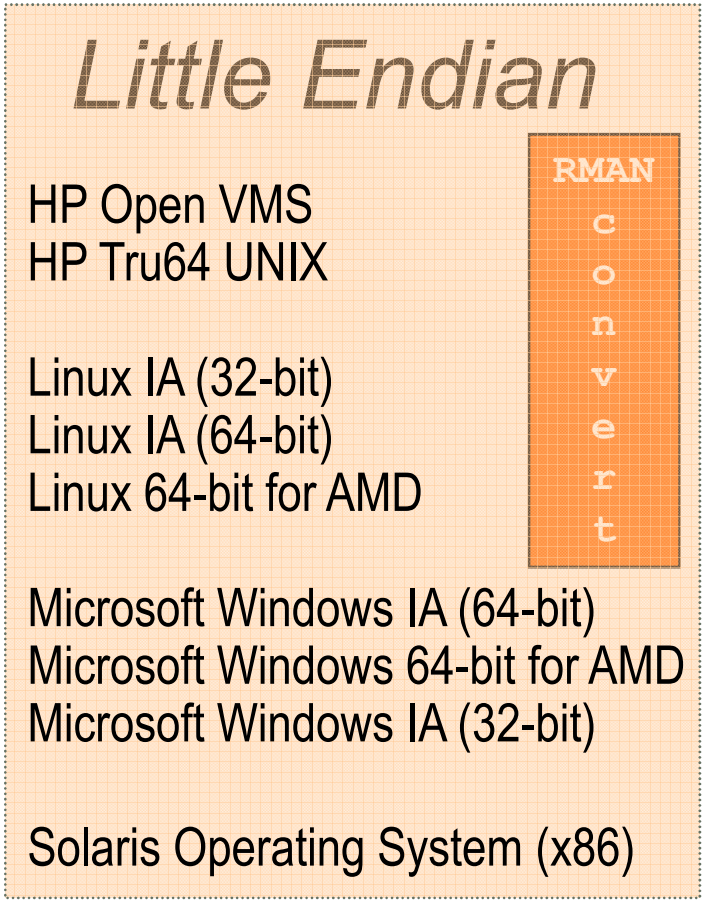
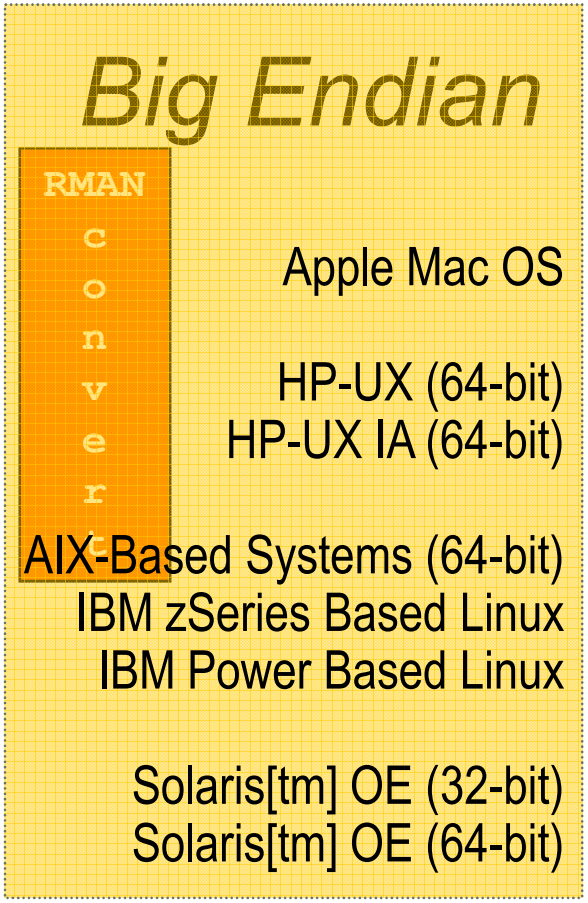
Transportable Database

- TDB x-platform (For OS naming conventions see: v$transportable_platform):





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Transportable Database

- Transportable Database - Information
  - Platform Migration using Transportable Database (RMAN):
    http://www.oracle.com/technetwork/database/features/availability/maa-wp-10gr2-platformmigrationtdb-131164.pdf
  - Note: 413586.1
    How To Use RMAN CONVERT DATABASE for Cross Platform Migration

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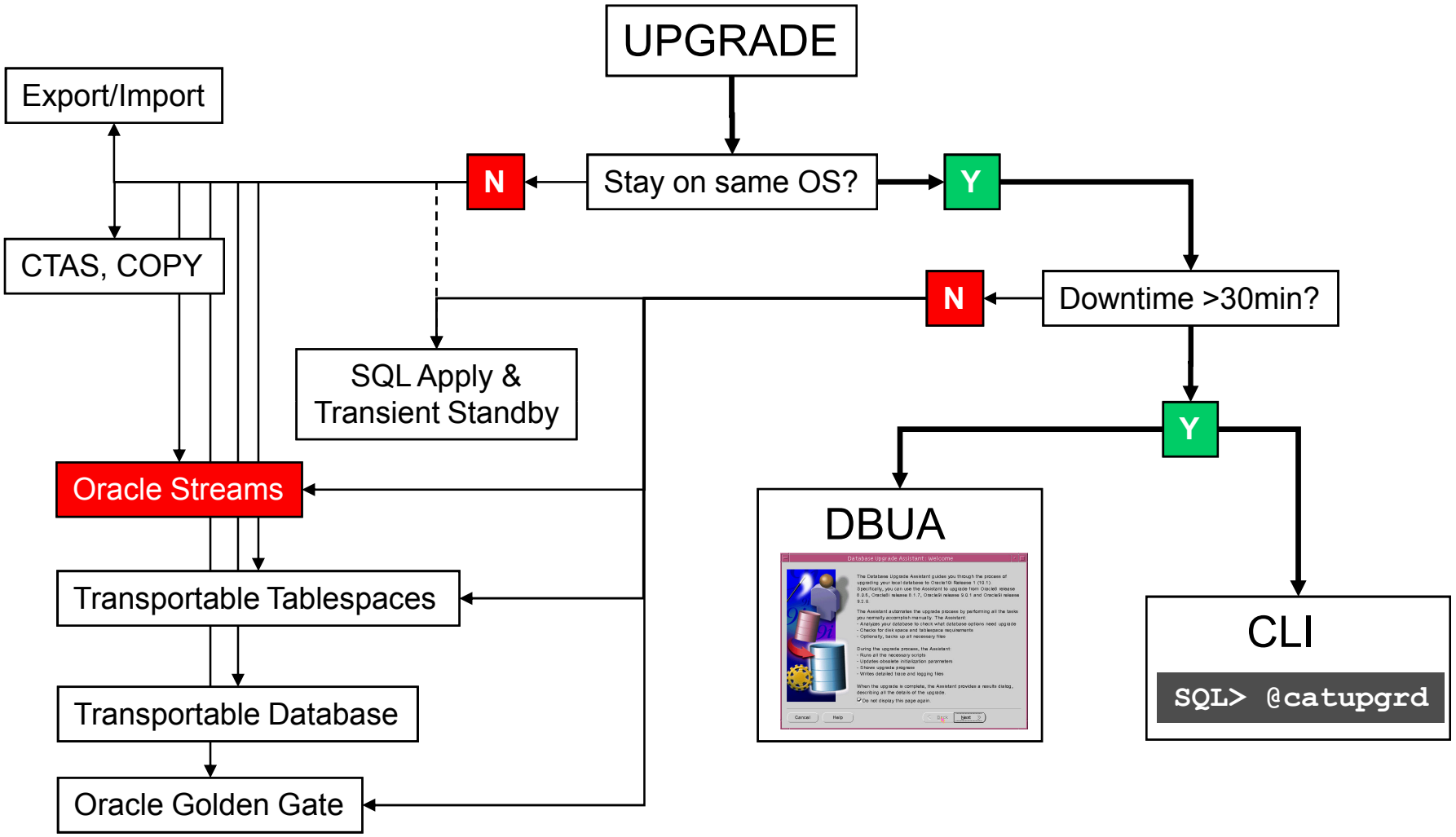
Upgrade Paths



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Oracle Streams

- Concept
  - Build up a copy of your database and upgrade it
  - Synchronize it with the source database
  - Downtime:
    - Just reconnecting the clients
  - Cross platform
  - Cross version since Oracle 9*i*R2
  - Some effort necessary to set it up
  - Fallback possible
  - Logminer
    - Datatype restrictions
    - Performance
  - How to:
    Oracle® Streams Concepts and Administration: Appendix D/E
    `http://download.oracle.com/docs/cd/E11882_01/server.112/e17069/ap_strmnt.htm#CIHJBIAA`

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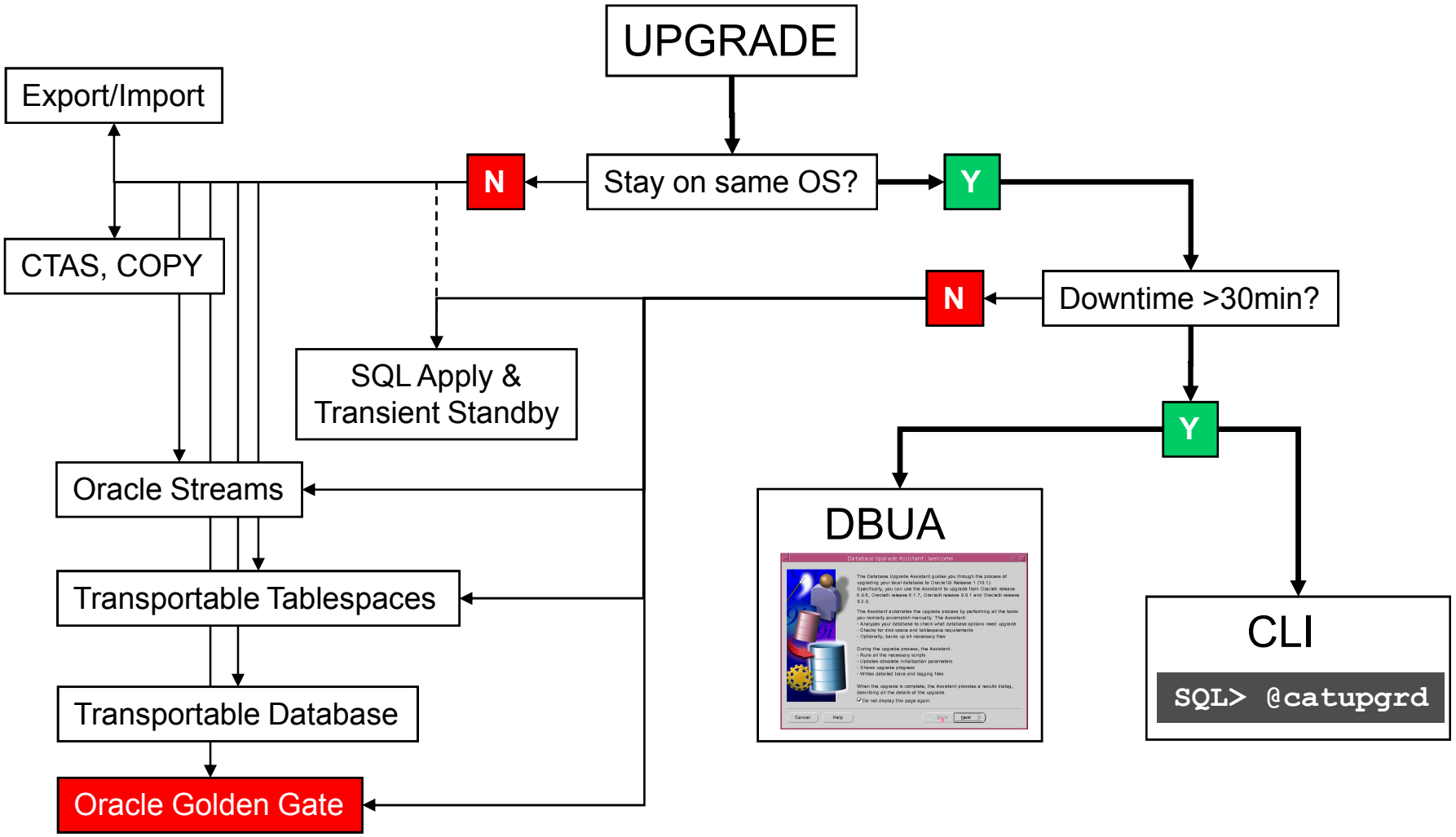
Upgrade Paths



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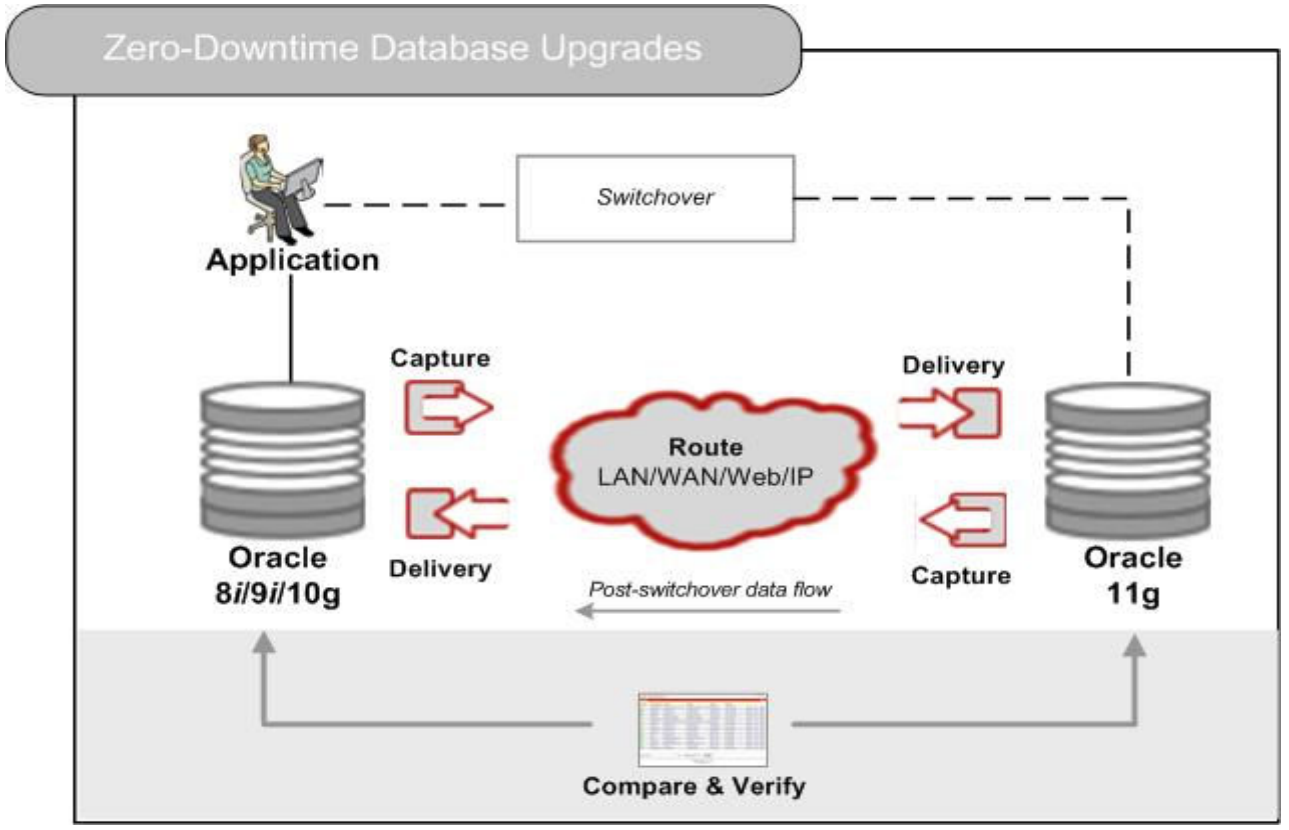
Oracle GoldenGate

- Concept
  - Create a copy of your database with TTS or exp/imp
  - GoldenGate CDG mechanism for synchronization



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Oracle GoldenGate

- Example: near-zero-downtime upgrade with Golden Gate

1. Start Oracle GoldenGate Capture module
2. Set up Clone database, then upgrade to Oracle Database 11g
3. Cross platform transportable tablespaces metadata export
4. Use a full database NOROWS export (Views, Packages, etc)

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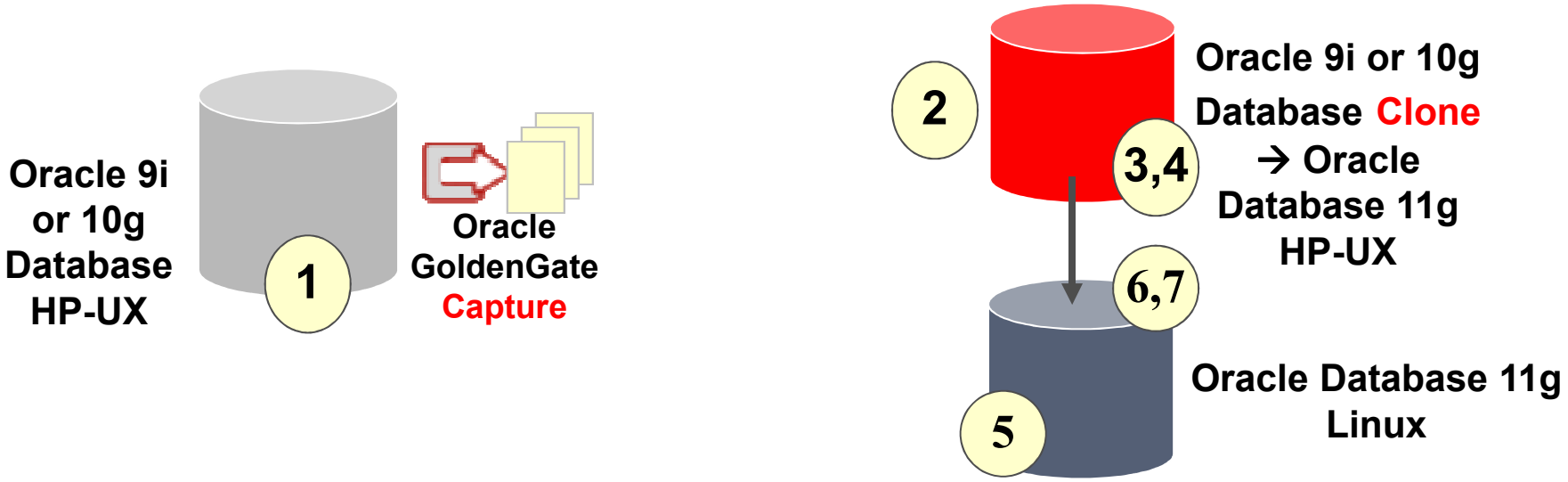
Oracle GoldenGate

- Example: near-zero-downtime upgrade with Golden Gate



5. Set up a new Oracle Database 11g vanilla target
6. Cross platform transportable tablespaces metadata import
7. Full import with IGNORE option

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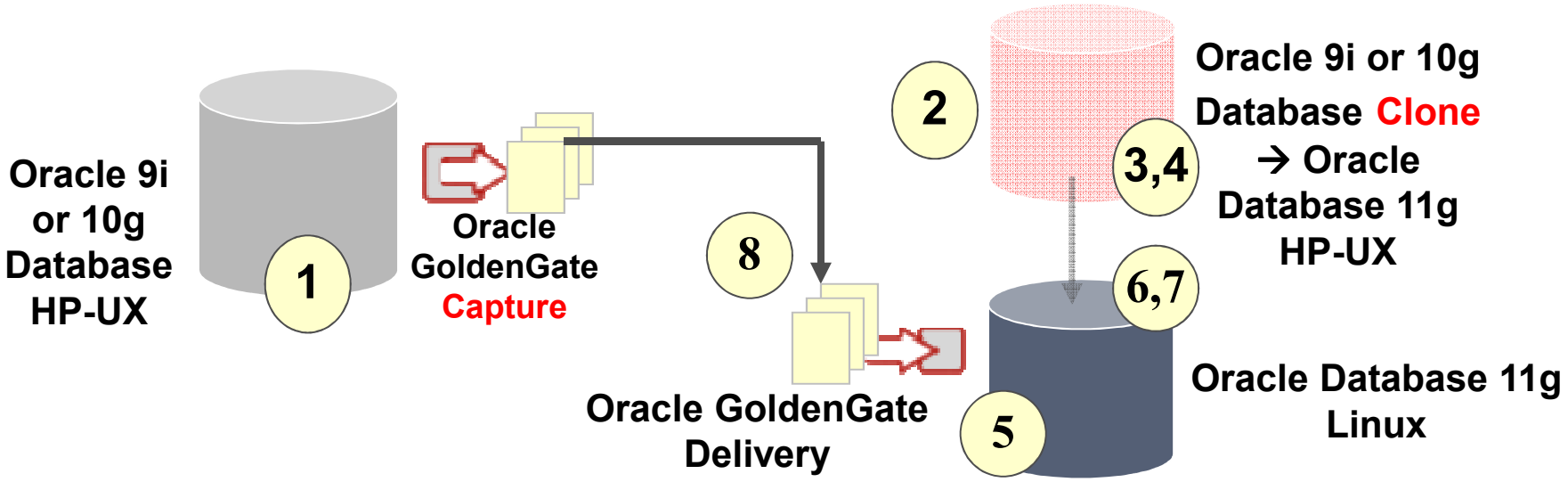
Oracle GoldenGate

- Example: near-zero-downtime upgrade with Golden Gate



8. Start Oracle Golden Gate delivery module on target
9. ** Switchover ** (not depicted)

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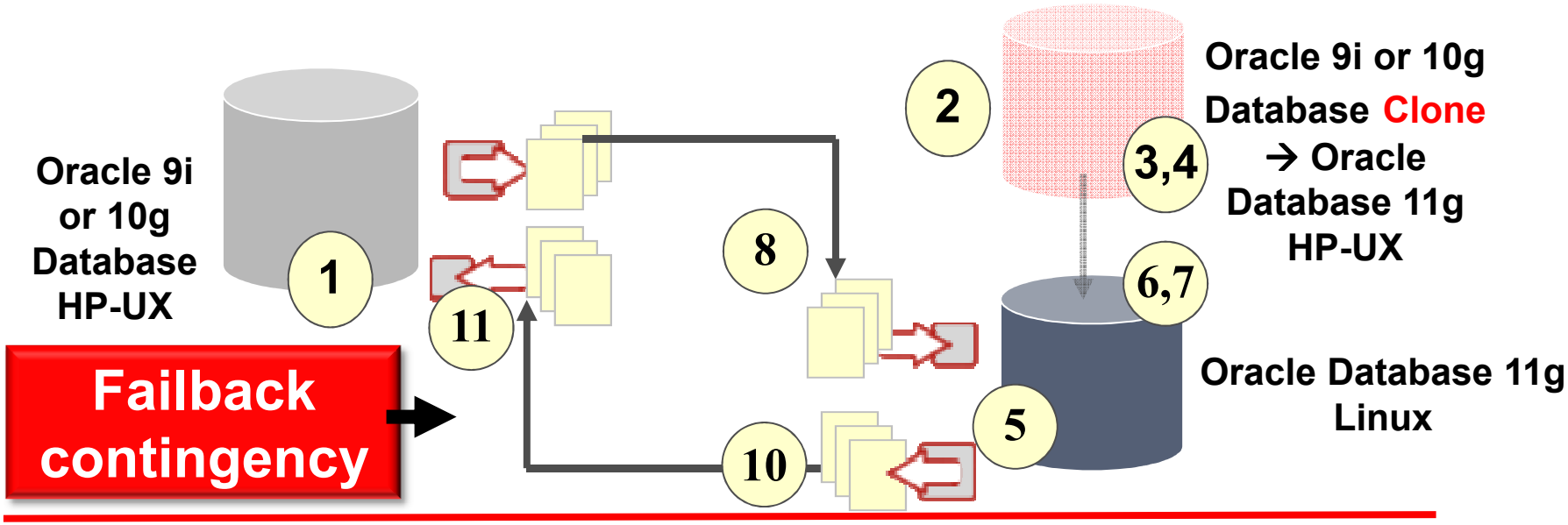
Oracle GoldenGate

- Example: Fallback with Golden Gate



10. Start Oracle GoldenGate's Capture at Oracle Database 11g
11. Start Oracle GoldenGate's Delivery process Oracle 9i or 10i Database (old source)

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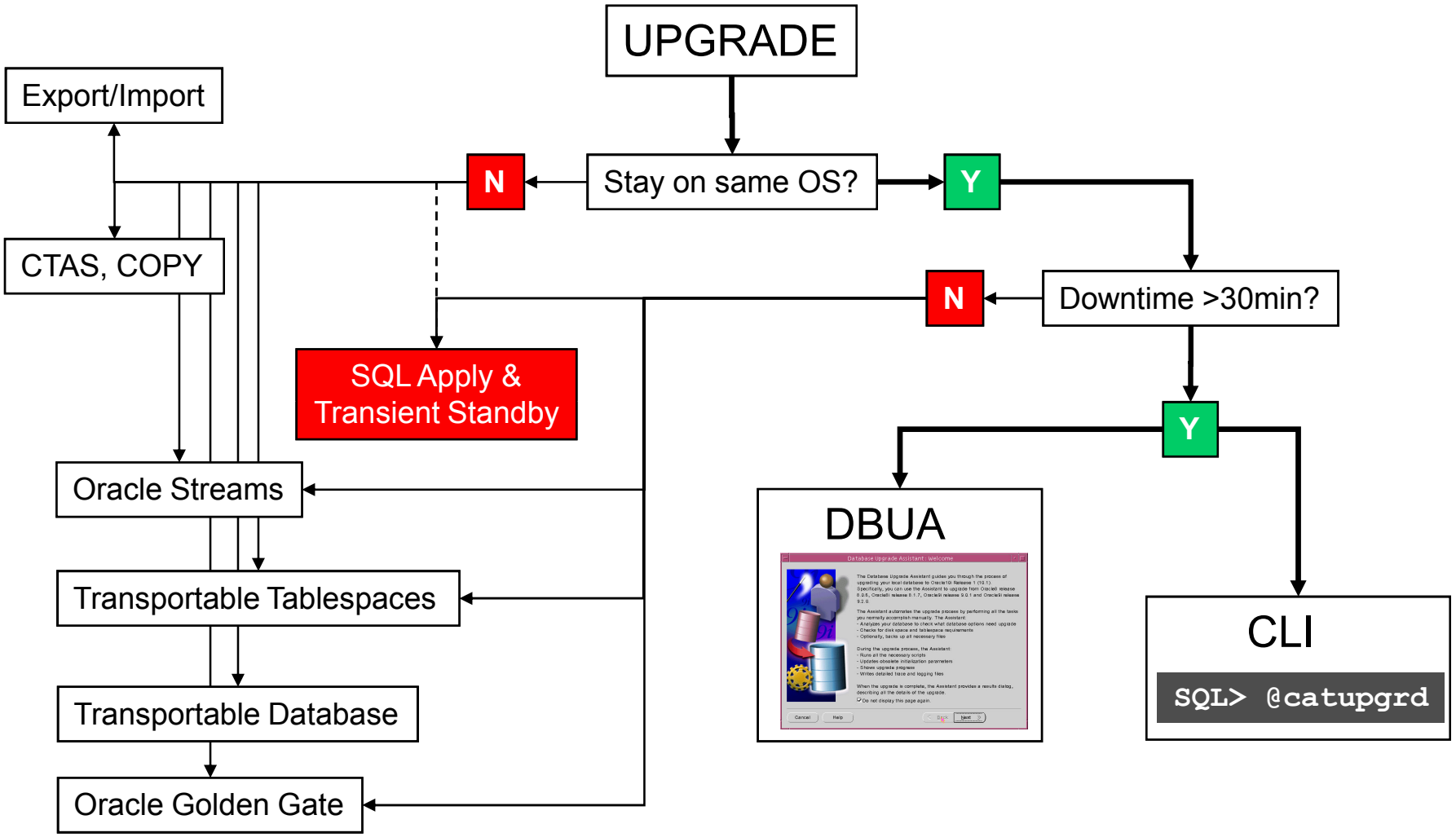
Upgrade Paths



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Logical Standby with Oracle Data Guard

- Concept:
  - Build up a Physical Standby database
  - Convert the Physical Standby into a Logical Standby
  - Upgrade the Logical Standby database
  - Switchover – Standby will be production system now
  - Then: Upgrade of the former production database
  - Eventually: Switchover to the original roles
    - Downtime less 2 minutes
    - BUT:
      - Usually no OS change possible
        - Exceptions: see MOS Note: 1085687.1
      - Logminer has known restrictions

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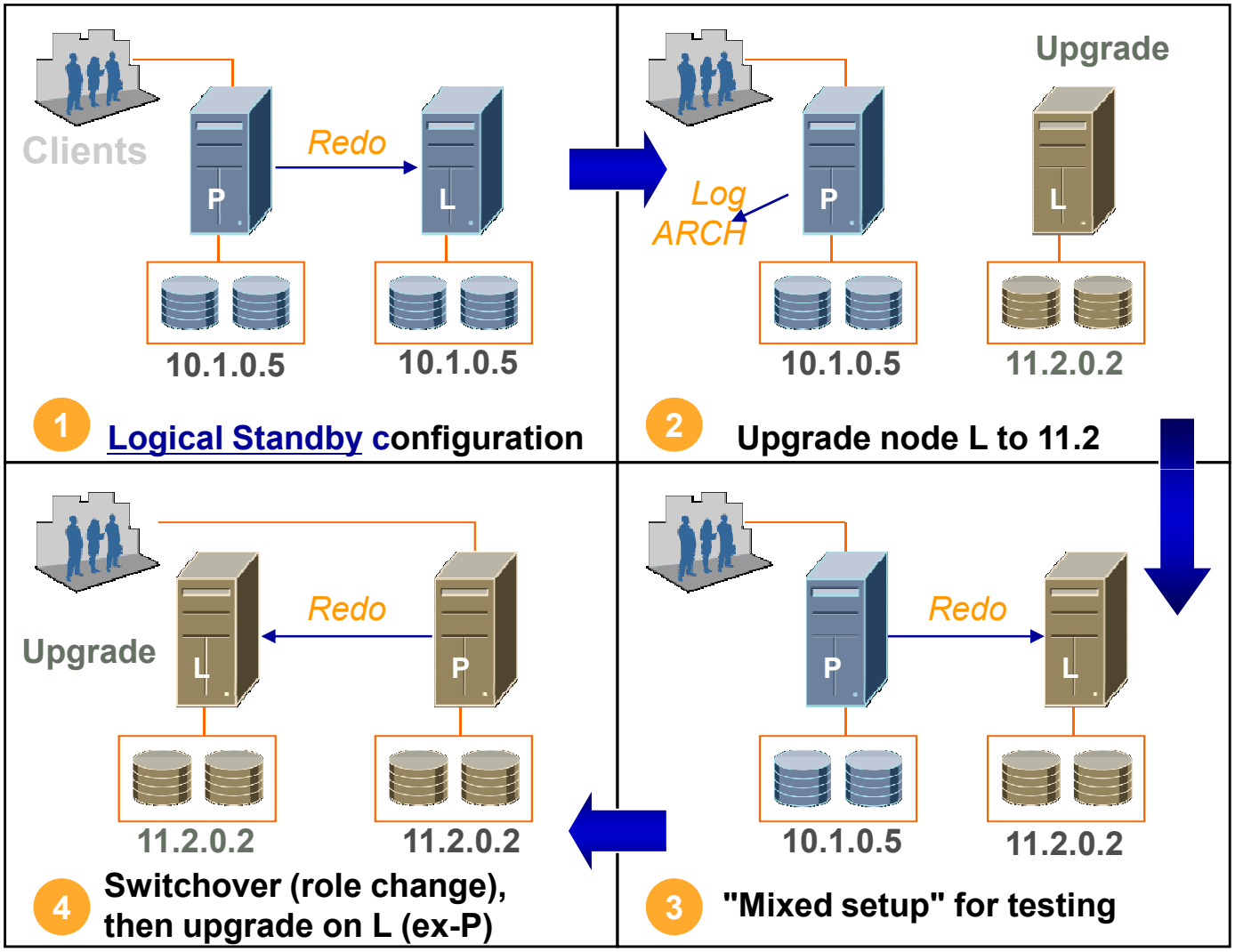
Logical Standby with Oracle Data Guard



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Upgrade Alternatives

- How to:
  - Patches, Links and Restrictions when upgrading from 10g: Note: 300479.1
  - Please see the documentation!!!
    11.1: http://download.oracle.com/docs/cd/B28359_01/server.111/b28294/create_ls.htm#g105412
    11.1: http://download.oracle.com/docs/cd/B28359_01/server.111/b28294/rollup.htm#BABJIDHI
  - Note:748595.1 (how to create a logical standby from a physical)
  - White Paper (see OTN.oracle.com => High Availability => MAA):
    Database Upgrades using SQL Apply
    http://www.oracle.com/technetwork/database/features/availability/maa-wp-10gr2-rollingupgradebestprac-1-132006.pdf
    Database Upgrades using a Transient Logical Standby
    http://www.oracle.com/technetwork/database/features/availability/maa-wp-11g-transientlogicalrollingu-1-131927.pdf

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Transient Logical Standby

- Concept:
  - Build up a Physical Standby database
  - Convert the Physical Standby into a Logical Standby
  - Upgrade the Logical Standby database
  - Switchover – Standby will be production system now
  - Then: Flashback the former production database
  - Convert it into a Physical Standby
  - Upgrade just by log apply
  - Eventually: Switchover to the original setup
    - Works pretty straight forward with Oracle Database 11g
      - Will work with Oracle Database 10g as well but requires more steps
  - Find shell scripts in Note:949322.1

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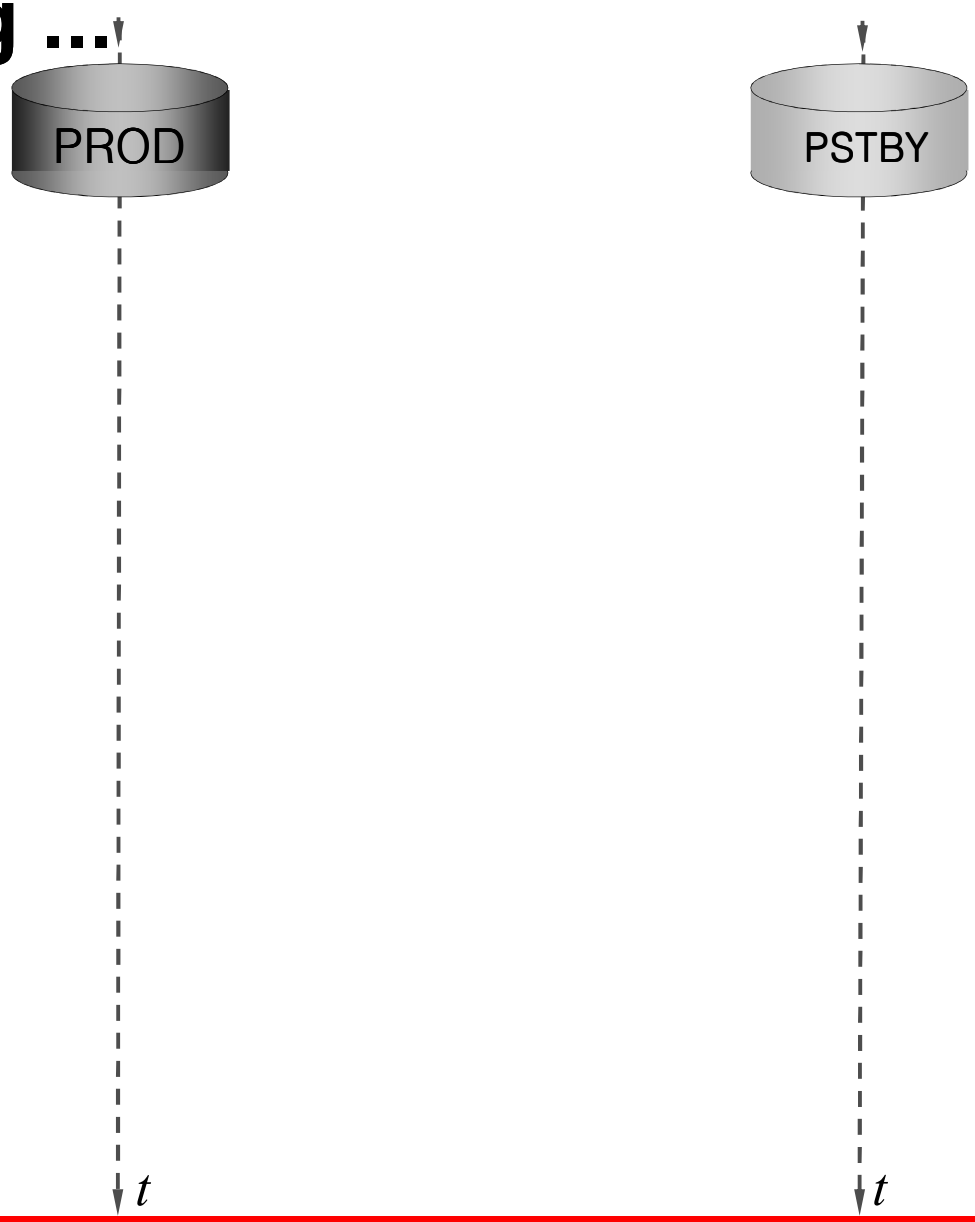
1

Rolling ...



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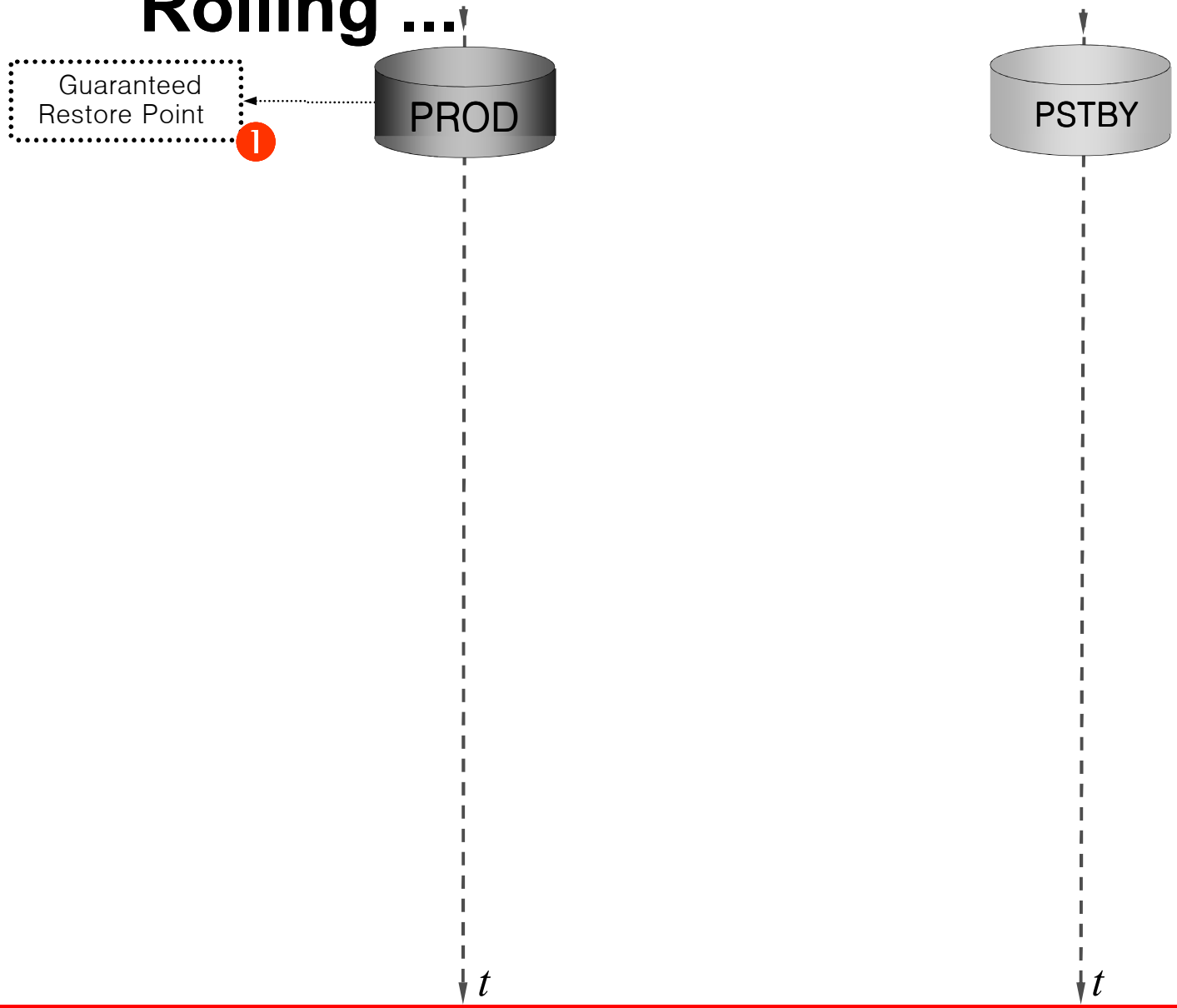
2

Rolling ...



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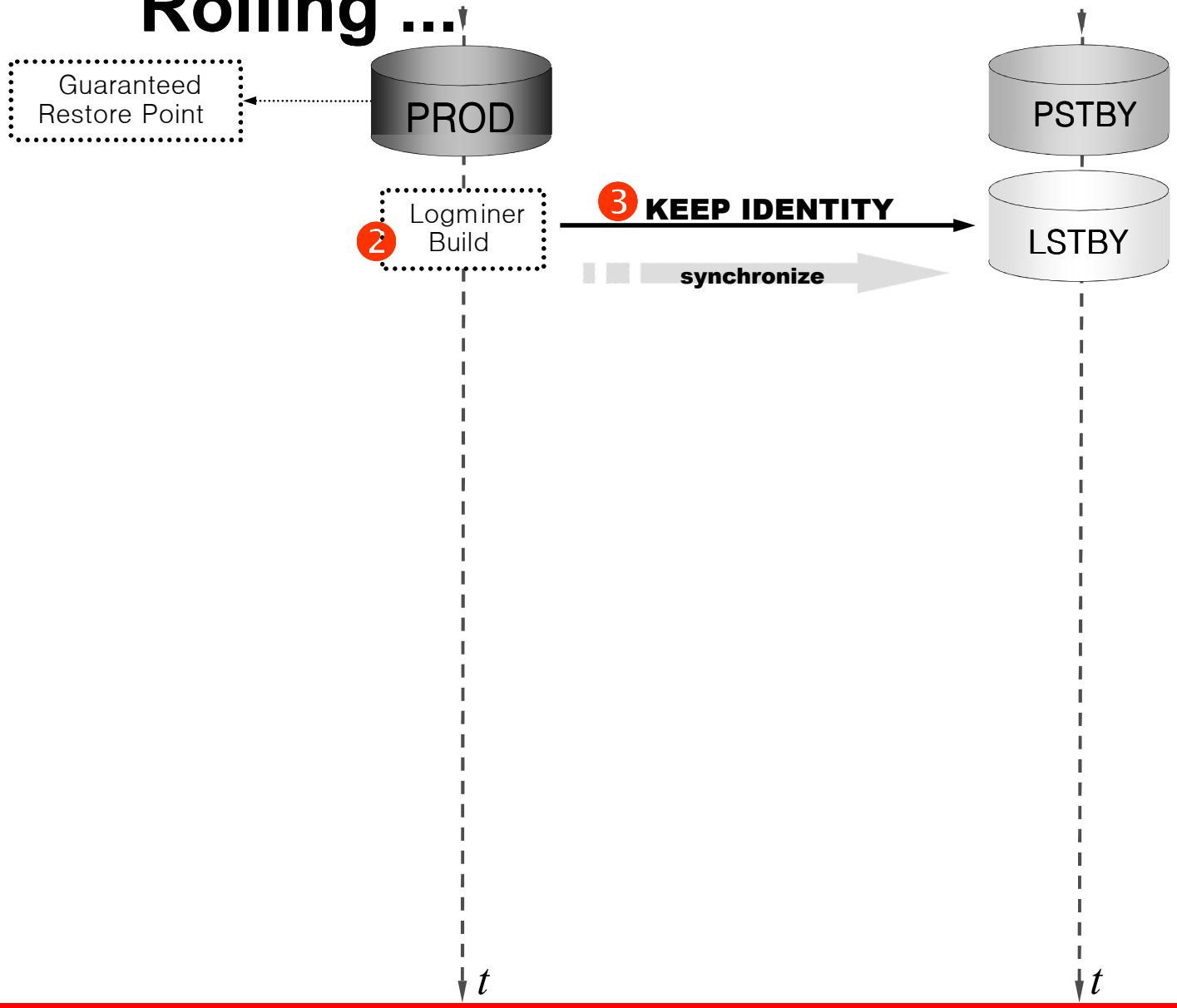
3

Rolling ...



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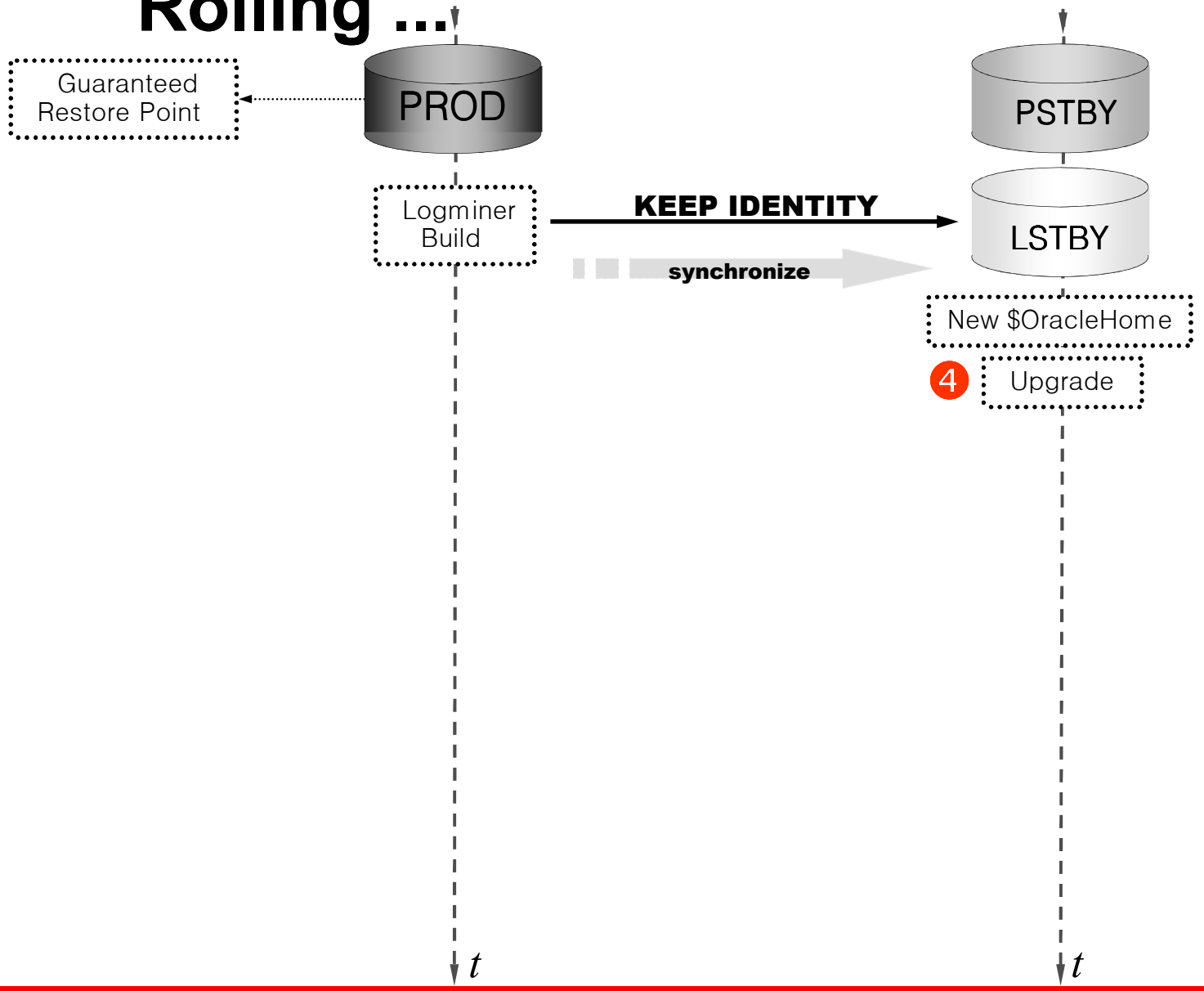
Rolling ...



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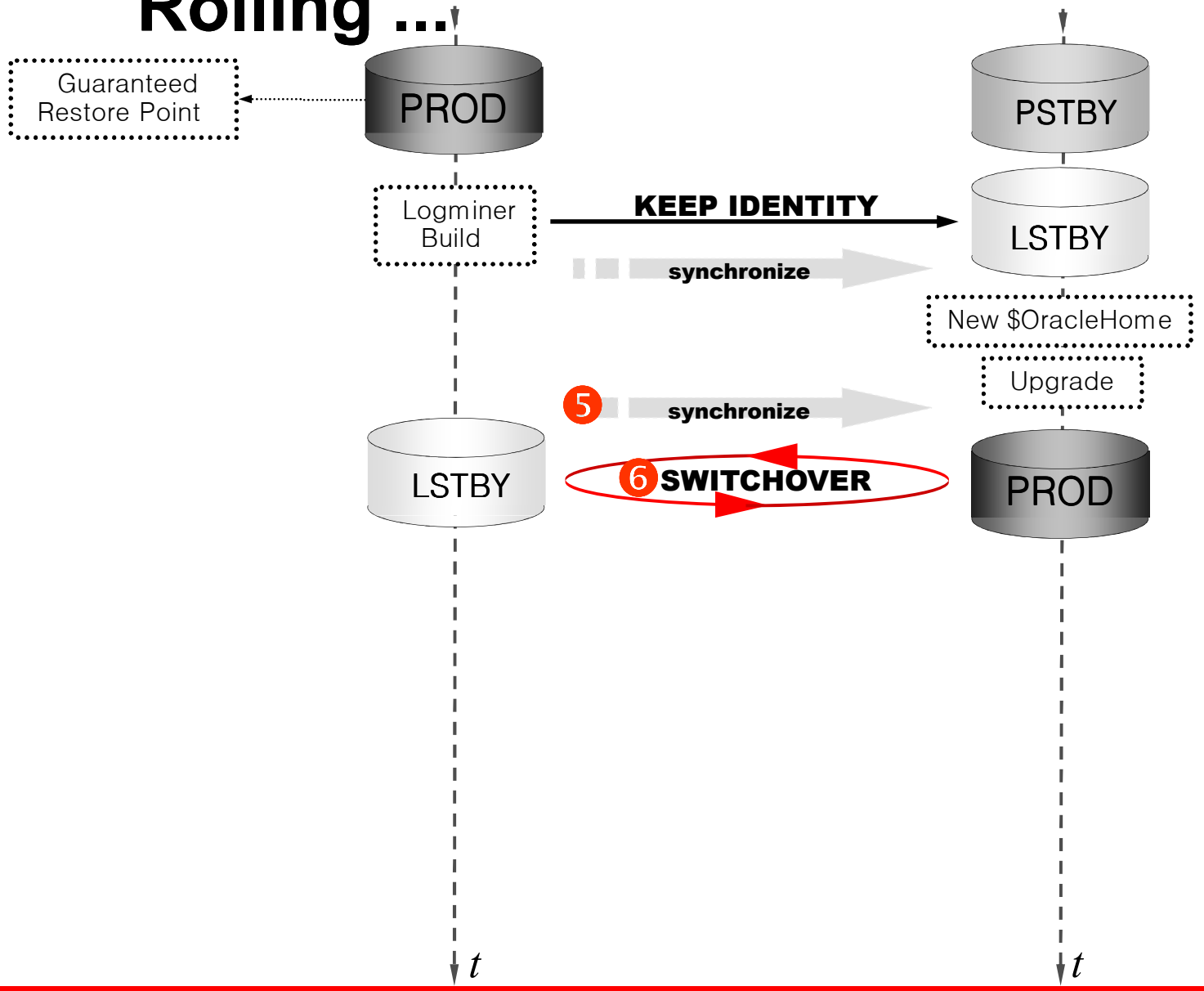
Rolling ...



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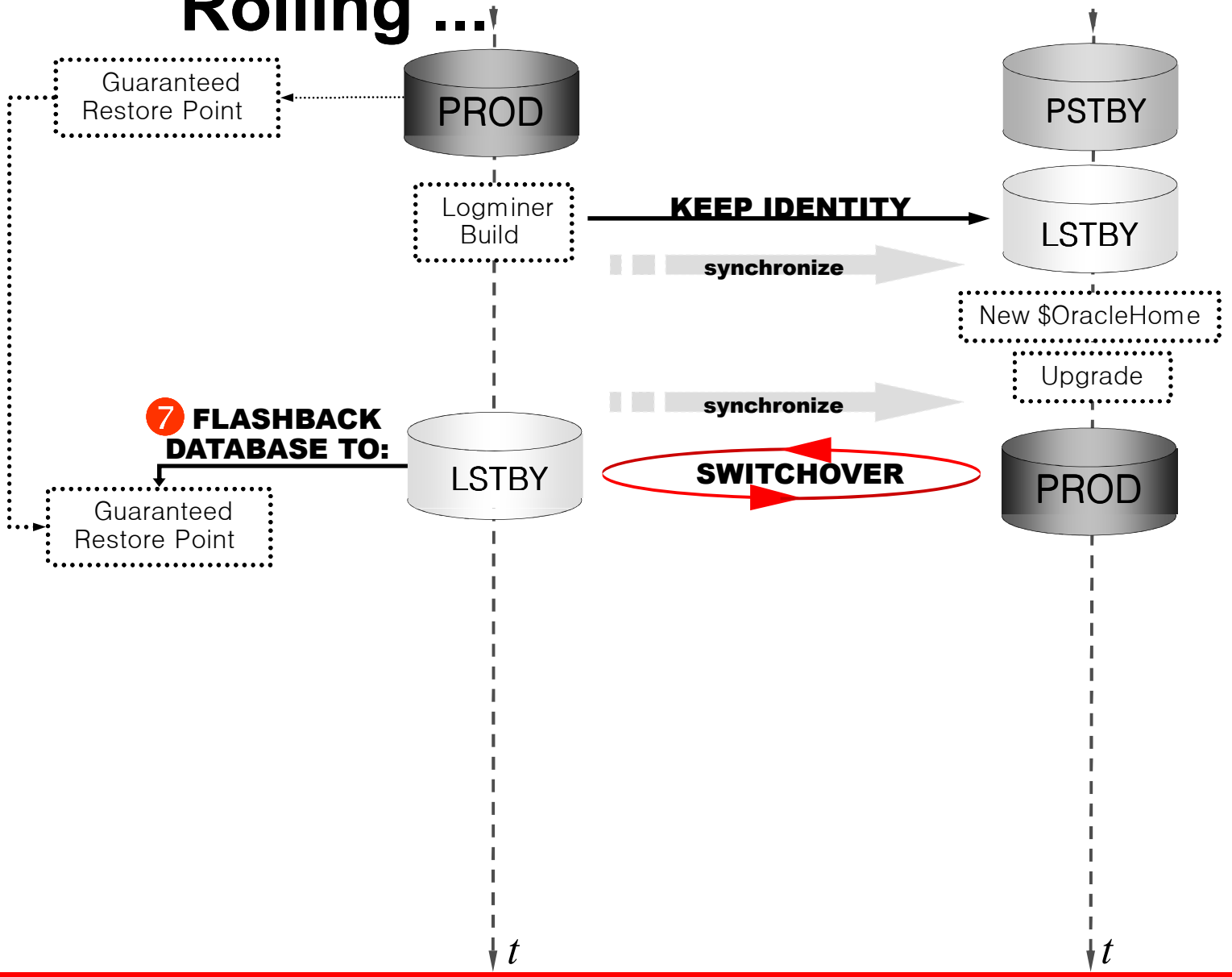
6

Rolling ...



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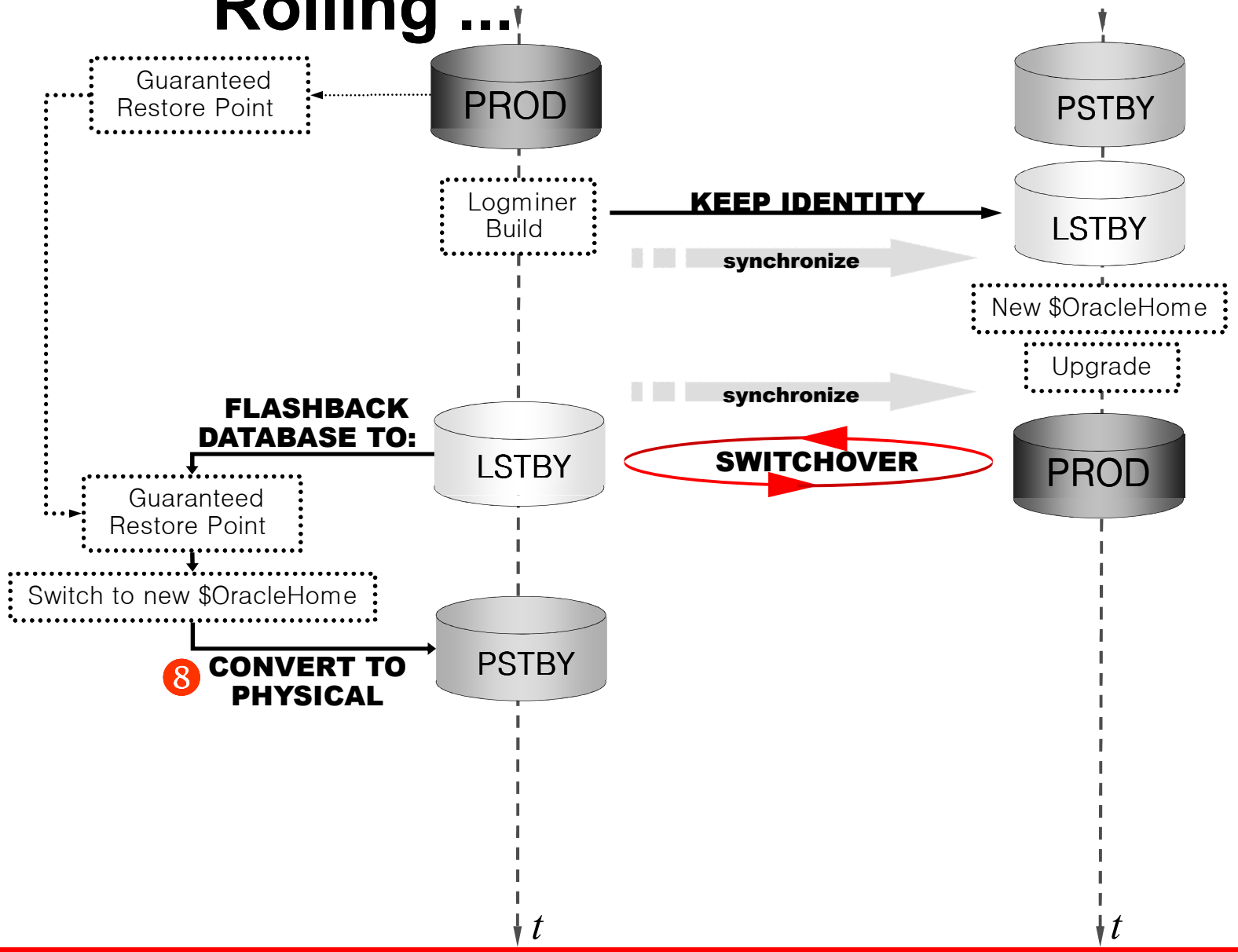
7

Rolling ...



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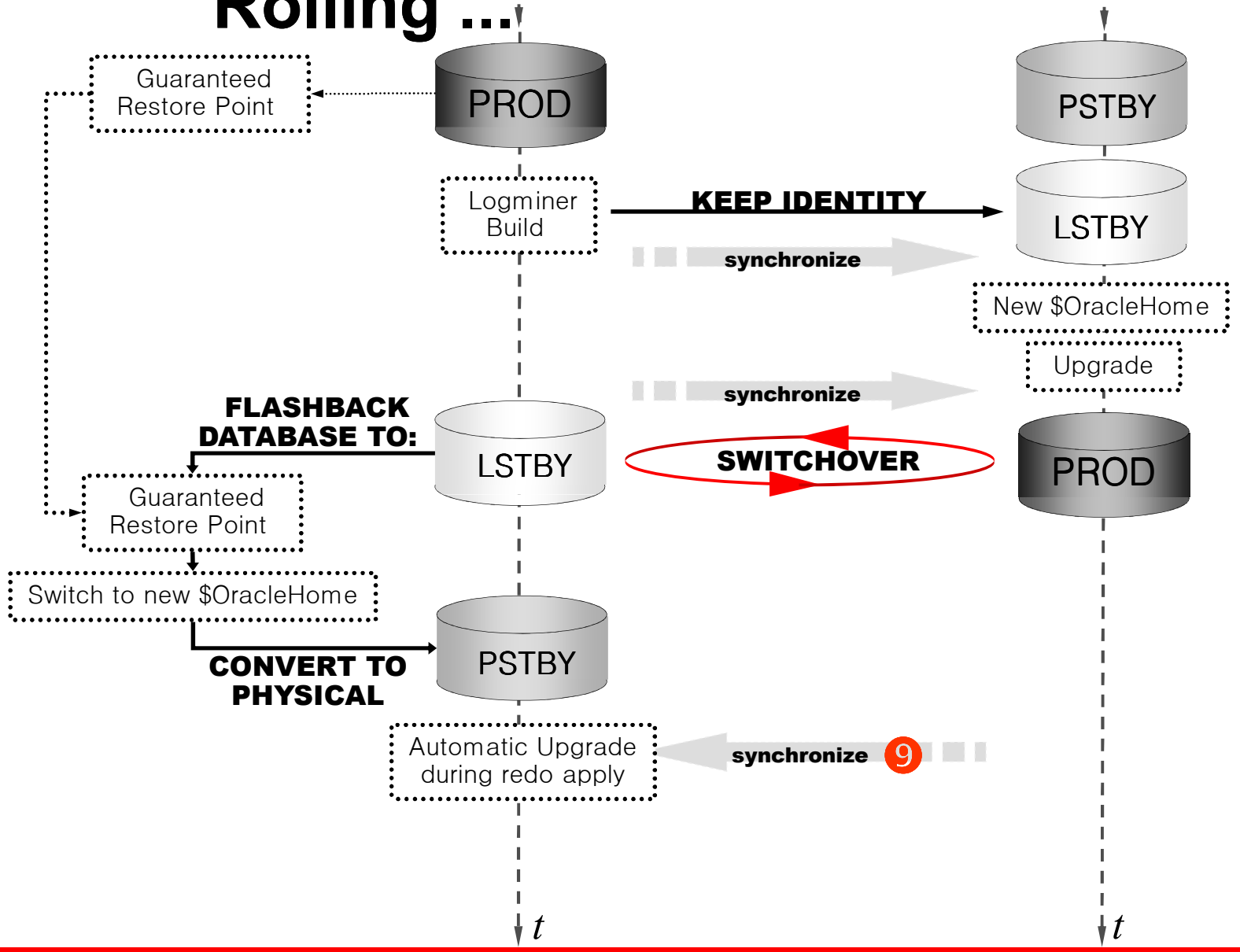
8

Rolling ...



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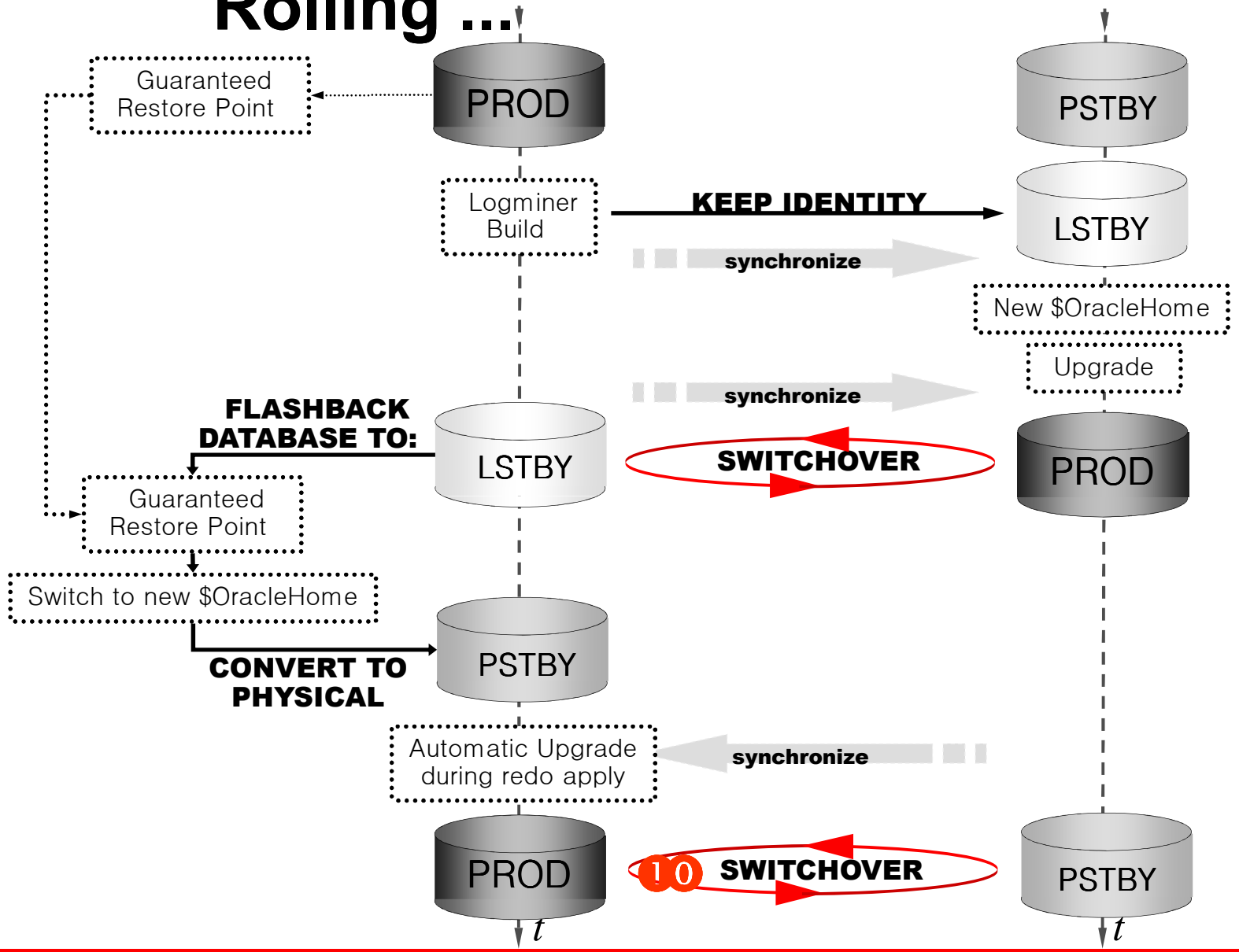
9

Rolling ...



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Transient Logical Standby

- Information:
  http://www.oracle.com/technetwork/database/features/availability/maa-wp-11g-transientlogicalrollingu-1-131927.pdf

Database Rolling Upgrade Using Transient Logical Standby: Oracle Data Guard 11g

Oracle Maximum Availability Architecture White Paper

September 2008

- Customer example:
  - Bielefeld University in Germany patches and upgrade with less than 2 minutes of downtime their RAC/ASM/DataGuard production systems
  - OOW 2009 presentation

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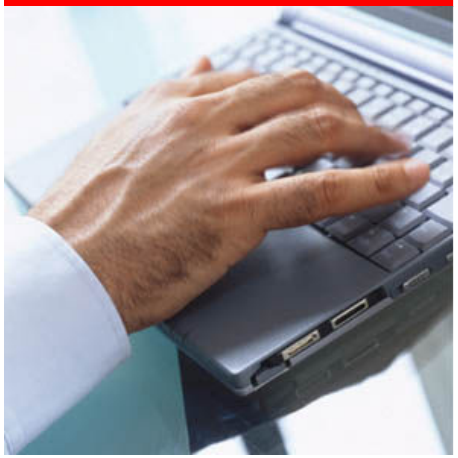
Agenda



- Preparation
- Installation
- Upgrade
  - Database Upgrade Assistant
  - Command Line Upgrade
  - Post Upgrade
  - Alternatives
  - Migration
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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Cross-Platform RMAN

- RMAN duplicate/restore/recovery Mixed Platform Support
  - Note:1079563.1
  - Mixed platforms are only supported for:
    - Active Database DUPLICATE
    - Backup-based DUPLICATE using image copies or backup sets
    - RESTORE and RECOVER using image copies or backup sets
- The following platform combinations are supported (in both directions):
  - Oracle 10.2 and above:
    - Solaris x64 ⇔ Linux x64
    - HP PA RISC ⇔ HP Itanium
    - Windows IA64 ⇔ Windows 64-bit for AMD / Windows (x86-64)
  - Oracle 11.1 and above (`COMPATIBLE ≥ 11.1`):
    - Linux ⇔ Windows
  - Oracle 11.2 and above:
    - Solaris SPARC (64bit) ⇔ IBM AIX (64bit) (source: non-RAC, non-TDE)

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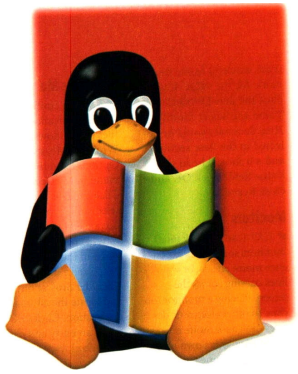
Platform Migration



- Data Guard Physical Standby
  - Goal:
    - Platform migration with a Physical Standby
  - Concept:
    - Build a physical standby database and do a switchover
  - Pros&Cons:
    + Only 1 minute downtime for a complete platform migration
    + Simple to setup
    + Since Oracle 11g: Win⇔Linux
    + Since Oracle 11.2.0.2: AIX ⇔ SPARC Solaris
      - For supported combinations see: Note:413484.1
    + For Oracle 9.2.0.7+8 and 10.2.0.2+3+4 and 11.1/2: HP-PA 11.23 ⇔ HP-IA64 – see: Note:395982.1

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OS change on HP: PA RISC ⇨ IA64

- Migration from HP PA-RISC (64bit) to HP Itanium ia64 Note:427712.1
  1) Complete valid backup
  2) Trace the controlfile
     - `SQL> alter database backup controlfile to trace as '/tmp/control_1.ctl';`
  3) Shutdown *immediate* (or *normal*)
  4) Copy all datafiles
  5) Startup nomount
  6) Create a new controlfile
  7) Possibly rebuild the JVM
     - `SQL> create or replace java system;`
- Or: Use a physical standby!
  Allowed since Oracle 9.2.0.7+8 and 10.2.0.2+3+4 and 11g:
  HP-PA 11.23 ⇔ HP-IA64 – see: Note:395982.1

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ASM Migration

- Migration to ASM
  - Option 1: RMAN
  - Option 2: Physical standby
    - Simple switchover will do the migration to ASM
      - Just 1 minute downtime
    - See:

Best Practices for Minimal Downtime Migration to ASM Oracle 10*g* Release 2

Oracle Maximum Availability Architecture White Paper
May 2007

http://www.oracle.com/technetwork/database/features/availability/maa-wp-10gr2-asmmigrationwithdg-133513.pdf

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RAC Migration

- Migration from Single Instance to RAC:
- See http://download.oracle.com/docs/cd/E11882_01/install.112/e17214/cvrt2rac.htm#BABBAHCH
  - Option 1: **`rconfig`** utility
    `http://download.oracle.com/docs/cd/E11882_01/install.112/e17214/cvrt2rac.htm#BABGGEGJ`
    - Modify `$ORACLE_HOME/assistants/rconfig/sampleXMLs/ConvertToRAC.xml`
    - Run `$ORACLE_HOME/bin/rconfig myconvert.xml`
  - Option 2: Enterprise Manager Grid Control
  - Option 3: Manual
    - Install Oracle Clusterware software
    - Install Oracle RAC software (or link with RAC option)
    - Reconfigure database to accommodate RAC settings
      - `@$ORACLE_HOME/rdbms/admin/catclust.sql`
      - init.ora
      - Register instances with `srvctl`

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Word size (32bit/64bit) Migration

- Changing between 32bit and 64bit Oracle Homes:
  - As part of an upgrade or patch set:
    - No action required – happens implicitly during upgrade/downgrade
    - Example: Upgrade of 10.2.0.3 on WinXP 32bit => 11.2.0.2 on Win7 64bit
  - As part of a migration only - without changing database version:
    - In the source environment:

```
startup upgrade; [startup migrate; -- for Oracle 9i]
@?/rdbms/admin/utlirp.sql
shutdown immediate
```

      In the destination environment:

```
startup upgrade
@?/rdbms/admin/utlrp.sql
```

    - OLAP must be reloaded – see Note:352306.1
    - Remember to adjust your init.ora memory parameters
    - Example:
      Move of 10.2.0.5 on WinXP 32bit => 10.2.0.5. on Win2008 64bit with 64bit $OH

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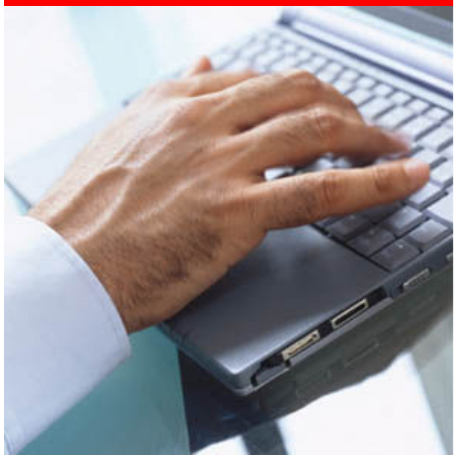
Agenda



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Parameters
Processes
Miscellaneous
Tools
Automation
LOB & SecureFiles
Flashback
ADR
Compression

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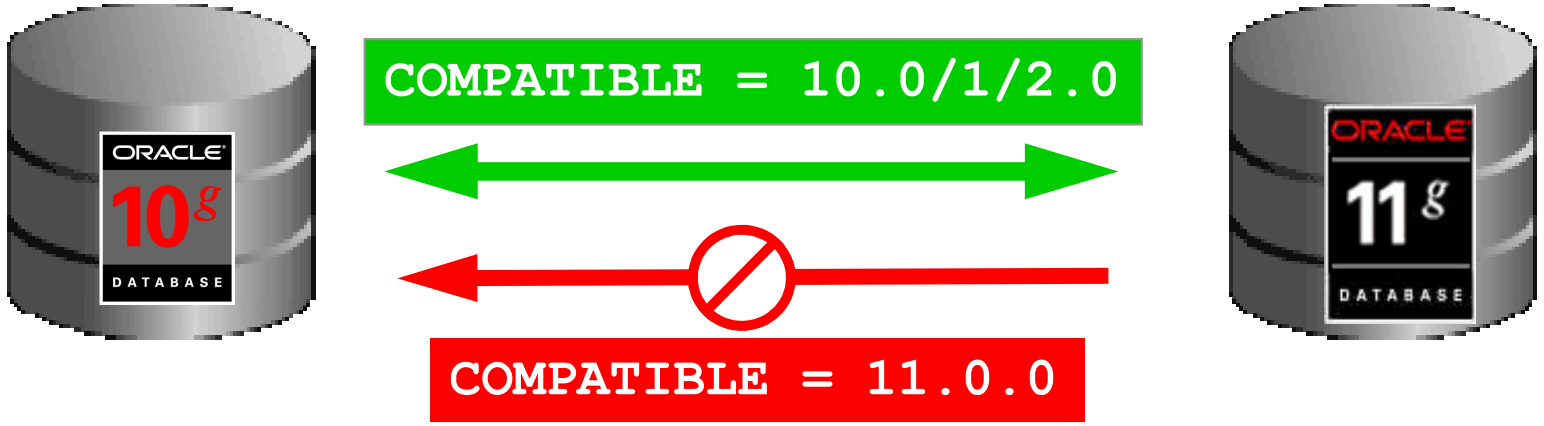
Parameter COMPATIBLE

- COMPATIBLE has to be at least 10.1.0 for an 11*g* database
- No way back once ≥11.1.0 has been enabled
  - Supported release downgrade to 10.1.0.5, ≥10.2.0.2, ≥11.1.0.6
  - No `ALTER DATABASE RESET COMPATIBILITY` command anymore



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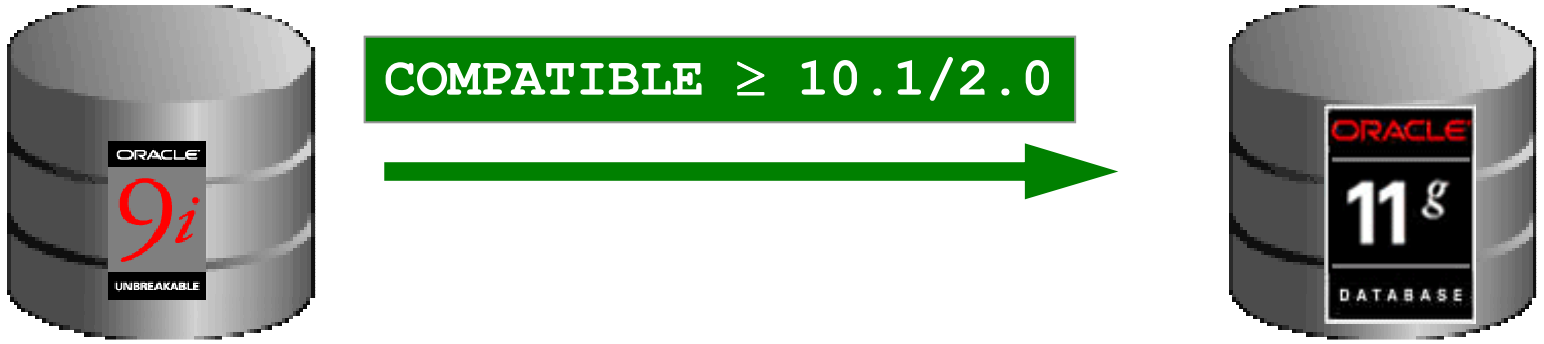
Parameter COMPATIBLE

- Upgrade 9*i* ⇨**11.1** precautions:
  - Make 100% sure that you've applied DST patches before starting the 9*i* database in an 11.1 environment
    - 9*i* ⇨11*g* requires `COMPATIBLE ≥ 10.1`
    - No possibility to have `COMPATIBLE=9.2.0`
    - No way back as soon as the database has be opened with an implicitly raised `COMPATIBLE` setting



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Parameter COMPATIBLE

- DBUA raises `COMPATIBLE` only for 9*i* databases
- To enable new features after the upgrade:
  - 11.1:

```
SQL> alter system
     set compatible='11.1.0' scope=spfile;
```

  - 11.2:

```
SQL> alter system
     set compatible='11.2.0' scope=spfile;
```

  - Afterwards: restart the database
    - New features will be enabled
    - Datafile headers will be adjusted
    - Redologfiles will be adjusted during first access

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New 11*g* Parameters

- New in 11.1.0.6:
  - ASM_PREFERRED_READ_FAILURE_GROUPS
    CLIENT_RESULT_CACHE_LAG
    CLIENT_RESULT_CACHE_SIZE
    COMMIT_LOGGING
    COMMIT_WAIT
    CONTROL_MANAGEMENT_PACK_ACCESS
    DB_LOST_WRITE_PROTECT
    DB_SECUREFILE
    DB_ULTRA_SAFE
    DDL_LOCK_TIMEOUT
    DIAGNOSTIC_DEST
    GLOBAL_TXN_PROCESSES
    JAVA_JIT_ENABLED
    LDAP_DIRECTORY_SYSAUTH
    MEMORY_MAX_TARGET
    MEMORY_TARGET
    OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES
    OPTIMIZER_USE_INVISIBLE_INDEXES
    OPTIMIZER_USE_PENDING_STATISTICS
    OPTIMIZER_USE_SQL_PLAN_BASELINES
    PARALLEL_IO_CAP_ENABLED
    PLSCOPE_SETTINGS
    REDO_TRANSPORT_USER
    RESOURCE_MANAGER_CPU_ALLOCATION
    RESULT_CACHE_MAX_RESULT
    RESULT_CACHE_MAX_SIZE
    RESULT_CACHE_MODE
    RESULT_CACHE_REMOTE_EXPIRATION
    SEC_CASE_SENSITIVE_LOGON
    SEC_MAX_FAILED_LOGIN_ATTEMPTS
    SEC_PROTOCOL_ERROR_FURTHER_ACTION
    SEC_PROTOCOL_ERROR_TRACE_ACTION
    SEC_RETURN_SERVER_RELEASE_BANNER
    XML_DB_EVENTS
- New in 11.1.0.7 (for Exadata/SAGE):
  - CELL_OFFLOAD_PROCESSING
    CELL_OFFLOAD_DECRYPTION
    CELL_OFFLOAD_PARAMETERS
    CELL_OFFLOAD_COMPACTION
    CELL_OFFLOAD_PLAN_DISPLAY

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New 11g Release 2 Parameters

- New in 11.2.0.1:
  - DEFERRED_SEGMENT_CREATION
    DST_UPGRADE_INSERT_CONV
    LISTENER_NETWORKS
    PARALLEL_DEGREE_LIMIT
    PARALLEL_DEGREE_POLICY
    PARALLEL_FORCE_LOCAL
    PARALLEL_MIN_TIME_THRESHOLD
    PARALLEL_SERVERS_TARGET
- New in 11.2.0.2:
  - CURSOR_BIND_CAPTURE_DESTINATION
    DB_UNRECOVERABLE_SCN_TRACKING
    DB_FLASH_CACHE_SIZE [Solaris and Linux only]
    DB_FLASH_CACHE_FILE [Solaris and Linux only]

- New Parameters can always be found in the **Database Reference** under *What's New in Oracle Database Reference?* or under *New Features*

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New Parameters 11*g* - Selection

- **CONTROL_MANAGEMENT_PACK_ACCESS**
  - Default: DIAGNOSTIC+TUNING
  - Values: DIAGNOSTIC+TUNING
    DIAGNOSTIC
    NONE
  - Purpose: Controls access to several functionalties of Diagnostic and Tuning Pack
  - Example:

```
CONTROL_MANAGEMENT_PACK_ACCESS=NONE

select count(*) from v$active_session_history;
==> 0 rows
```

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New Parameters 11*g* - Selection

- **DIAGNOSTIC_DEST**
  - Default: $ORACLE_BASE
  - Value: OS path/directory
  - Layout: **<diagnostic_dest>/diag/rdbms/<dbname>/<instname>**
  - Purpose: Substitutes **background_dump_dest**, **user_dump_dest**, listener trace etc. and specifies the ADR home (Automatic Diagnostic Repository)

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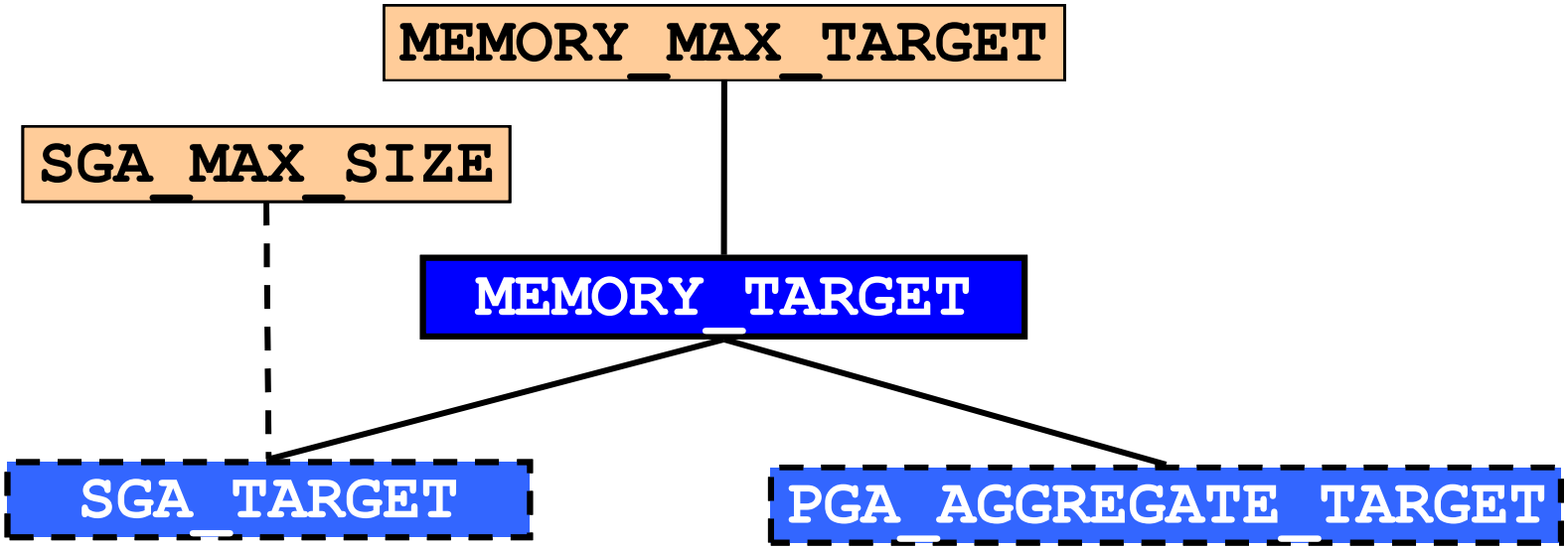
New Parameters 11*g* - Selection

- **MEMORY_TARGET** and **MEMORY_MAX_TARGET**
  - Default: 0
  - Value: *integer* [K | M | G]
  - Purpose: Specifies the complete plus the maximum memory available to the Oracle server



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New Parameters 11*g* - Selection

- **OPTIMIZER_USE_INVISIBLE_INDEXES**
  - Default: FALSE
  - Values: TRUE
    FALSE
  - Purpose: "Invisible" indexes will be ignored by the optimizer if set to FALSE. But DMLs will be still executed to the index.
  - Motivation: Isolated testing of performance effects of an index based on a session level
  - Example:

```
CREATE INDEX emp_ename ON emp(ename)
INVISIBLE;

ALTER SESSION SET
 OPTIMIZER_USE_INVISIBLE_INDEXES=TRUE;
```

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New Parameters 11*g* - Selection

- **SEC_CASE_SENSITIVE_LOGON** 1/2
  - Default: TRUE
  - Values: TRUE
    FALSE
  - Purpose: Switches on/off the case sensitivity of passwords
    Attention: also valid for database links!!
  - Info:

```
SELECT username, password_versions FROM dba_users;

USERNAME   PASSWORD_VERSIONS
---------- -----------------
JONES      10G 11G
PRESTON    11G
BLAKE      10G
```

Changed in:

Created in:

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New Parameters 11*g* - Selection

- **SEC_CASE_SENSITIVE_LOGON** 2/2
  - Switching on the case sensitivity password mode can have several impacts:
    - Scripts with user/pw like `SCOTT/TIGER` won't run anymore if the user gets created or altered e.g. as `SCOTT/tiger` in 11g
      - Annotation: Upon upgrading the "old" mechanism is still valid
    - Check password encrypted database links
  - Can be enabled also for the password file checkings
    - `orapwd file=orapwSID password=GeHeIm ignorecase=n`
  - Very helpful:
    Check view for default passwords: **DBA_USERS_WITH_DEFPWD**

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New Parameters 11*g* – Known Issue

- **SEC_CASE_SENSITIVE_LOGON=TRUE**
  - Access the database with an 10.2 SQL*Plus session and let the user change the password:
    - Result: ORA-1017 => invalid username/password
    - Known issue:
      Bug 6277160 CONNECTION WITH OCIPASSWORDCHANGE FAILS WHEN 10GR2 CLIENT CALLS 11G SERVER
    - Fixed in 10.2.0.5 and with any 11g client
    - Remedy:
      a) Apply client patch
      b) Upgrade your clients to 11g clients
    - For further information see Note:888432.1

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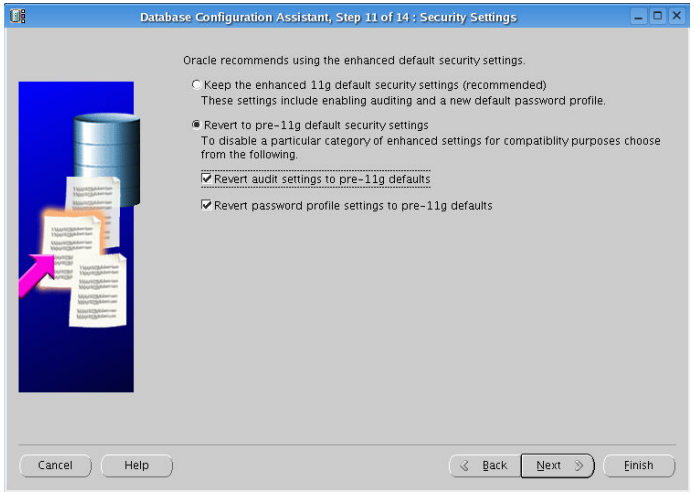
New Parameter Defaults 11*g*

- **AUDIT_TRAIL**
  - Default: NONE or DB
  - Values: NONE
    OS
    XML
    DB
    DB_EXTENDED



  - Purpose: Will help auditing security relevant statements. Upon an upgrade **AUDIT_TRAIL** keeps its default from 9.2/10.1/10.2 (NONE). If a 11g database is created from scratch then it'll set to DB and statements get logged in **SYS.AUD$**

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New Parameter 11*g* Release 2 - Selection

- **DEFERRED_SEGMENT_CREATION**
  - Default: TRUE
  - Values: TRUE
    FALSE
  - Purpose:
    Newly created table will just allocate segments when a row gets inserted
    - Tablespace must be locally managed
    - COMPATIBLE ≥ 11.2.0
    - New behaviour - default in 11g^{R2}
    - Advantage:
      - Save disk space when a high number of tables will be created but never populated
      - Application installation time is reduced
    - Please note:
      - Small performance penalty when the first row is inserted, because the new segment must be created at that time.

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New Parameter 11*g* Release 2 - Selection

- **_memory_imm_mode_without_autosga**
  - Default: TRUE
  - Values: TRUE
    FALSE
  - Purpose:
    Switching this parameter to FALSE will prevent the SGA from doing resize operations even though neither SGA_TARGET nor MEMORY_TARGET are set.
    - Explanation:
      A generic enhancement in 11.2.0.1 was made to allow IMMEDIATE mode requests even when sga_target (or memory_target) is not set. This enhancement has been introduced to prevent ORA-4031 errors due to shared pool pressure.
    - Feature can be turned off:
      `alter system set "_memory_imm_mode_without_autosga"=FALSE;`
    - Further information: Note:1269139.1

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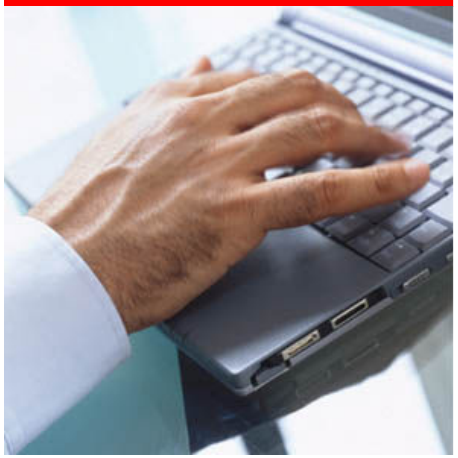
Agenda



- Preparation
- Installation
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

Parameters
Processes
Miscellaneous
Tools
Automation
LOB & SecureFiles
Flashback
ADR
Compression

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Background Processes

- Example:

```
select name, description from v$bgprocess, v$process
 where paddr=addr;

NAME  DESCRIPTION                    NAME  DESCRIPTION
----- ----------------------------   ----- --------------------------
ARC0  Archival Process 0             MMAN  Memory Manager
ARC1  Archival Process 1             MMNL  Manageability Monitor Pr 2
ARC2  Archival Process 2             MMON  Manageability Monitor Pr
ARC3  Archival Process 3             PMON  process cleanup
CJQ0  Job Queue Coordinator          PSP0  process spawner 0
CKPT  checkpoint                     QMNC  AQ Coordinator
DBRM  Resource Manager process       RECO  distributed recovery
DBW0  db writer process 0            SMCO  Space Manager Process
DIA0  diagnosibility process 0       SMON  System Monitor Process
DIAG  diagnosibility process         VKRM  Virtual sKeduler for RMgr
DSKM  slave DiSKMon process          VKTM  Virtual Keeper of TiMe pr
FBDA  Flashback Data Archiver Pr.
GEN0  General Task Execution Pr.
LGWR  Redo etc.
```

RED: New in 11gR1 *BLUE: New in 11gR2*

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New Background Processes

Process Name	Description	Found
ACMS	In an RAC environment, this per-instance process (Atomic Controlfile to Memory Service) is an agent which contributes to ensuring a distributed SGA memory update is either globally committed on success or globally aborted in the event of a failure.	RAC
DIA0	Responsible for hang detection and deadlock resolution.	ALL
DIAG	Performs diagnostic dumps and executes global oradebug commands.	ALL
DBRM	The Resource Manager process is responsible for setting Resource Plans and other Resource Manager related tasks.	ALL
EMNC / e0xx	The Event Monitor Coordinator coordinates the event management and notification activity in the database which includes Streams Event Notifications, Continuous Query Notifications and Fast Application Notifications.	ALL with any registered event activity (optional non-fatal)
FBDA	The process archives historical rows for tracked tables into flashback data archives and manages the flashback archives.	ALL
GEN0	General Task Execution Process. Performs required tasks including SQL and DML.	ALL
GMON	Maintains disk membership in ASM disk groups	ASM
GTX0-j	Provides transparent support for XA global transactions in a RAC environment. The database autotunes the number of these processes based on the workload of XA global transactions.	RAC only

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New Background Processes

Process Name	Description	Found
KATE	ONLY 11.1 -- Performs proxy I/O to an ASM metafile when a disk becomes offline.	**ASM, spawned on demand.**
MARK	Marks ASM Allocation Units as stale following a missed write to an offline disk.	**ASM, spawned on demand.**
PING	Interconnect Latency Measurement Process. Assesses latencies associated with communications for each pair of cluster instances.	**RAC only**
PSP0	Spawns Oracle processes.	**ALL**
RMSn	The RAC Management Processes perform manageability tasks for RAC, e.g. creation of RAC related resources when new instances are added to the clusters	**RAC only**
RMSN	In a RACenvironment, this process manages background slave process creation and communication on remote instances. These background slave processes perform tasks on behalf of a coordinating process running in another instance.	**RAC only**
SMCO / Wnnn	The space management coordinator process coordinates the execution of various space management related tasks, such as proactive space allocation and space reclamation. It dynamically spawns slave processes (Wnnn) to implement the task.	**ALL (optional non-fatal)**
VKRM	VKRM manages the CPU scheduling for all managed Oracle processes. The process schedules managed processes in accordance with an active resource plan. Resource Manager.	**ALL (optinolal)**
VKTM	The Virtual Keeper of TiMe[?] is responsible for providing a Wall-Clock time (updated every second) and Reference-Time Counter (updated every 20ms and available only when running at elevated priority).	**ALL**

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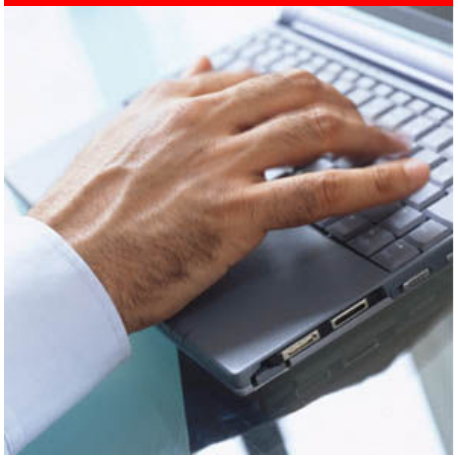
Agenda



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CONNECT Role

- The CONNECT Role has been changed since 10g^{R2}:

```
GRANTEE                        PRIVILEGE
------------------------------ ----------------------
CONNECT                        CREATE VIEW
CONNECT                        CREATE TABLE
CONNECT                        ALTER SESSION
CONNECT                        CREATE CLUSTER
CONNECT                        CREATE SESSION
CONNECT                        CREATE SYNONYM
CONNECT                        CREATE SEQUENCE
CONNECT                        CREATE DATABASE LINK
```

```
GRANTEE                        PRIVILEGE
------------------------------ ----------------------
CONNECT                        CREATE SESSION
```


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CONNECT Role

- Find out affected database users:

```
SELECT grantee
  FROM dba_role_privs
 WHERE granted_role = 'CONNECT' and
       grantee NOT IN ('SYS', 'OUTLN', 'SYSTEM',
                       'CTXSYS', 'DBSNMP',
                       'LOGSTDBY_ADMINISTRATOR',
                       'ORDSYS', 'ORDPLUGINS',
                       'OEM_MONITOR', 'WKSYS',
                       'WKPROXY', 'WK_TEST',
                       'WKUSER', 'MDSYS',
                       'LBACSYS', 'DMSYS', 'WMSYS',
                       'EXFSYS', 'SYSMAN',
                       'MDDATA', 'XDB', 'ODM',
                       'SI_INFORMTN_SCHEMA');
```

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Shared Pool calculation since 10*g*

- Parameter shared_pool_size is calculated differently since 10*g*
  - Real shared pool = shared_pool_size – startup overhead

```
SQL> select * from v$sgainfo;

NAME                                  BYTES RES
------------------------------ ---------- ---
Fixed SGA Size                      1266372 No
Redo Buffers                        2924544 No
Buffer Cache Size                  16777216 Yes
Shared Pool Size                   83886080 Yes
Large Pool Size                           0 Yes
Java Pool Size                     50331648 Yes
Streams Pool Size                         0 Yes
Granule Size                        4194304 No
Maximum SGA Size                  155189248 No
Startup overhead in Shared Pool    29360128 No
Free SGA Memory Available                 0
```

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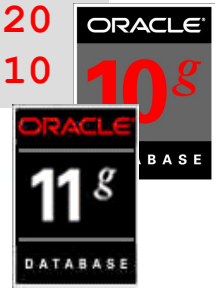
GROUP BY results: unsorted

- Hash Group by aggregation which allows a hash algorithm to process group by statements
  - For sorts ORDER BY has to be used

```
select sum(sal), deptno from scott.emp group by deptno;
```

```
  SUM(SAL)     DEPTNO
---------- ----------
      8750         10
     10875         20
      9400         30
```

```
  SUM(SAL)     DEPTNO
---------- ---------
      9400         30
     10875         20
      8750         10
```



  - Description see Note:345048.1
    - `_gby_hash_aggregation_enabled=false`

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Secure-View-Merging Privilege

- To prevent optimizer issues in since $10g^{R2}$ complex view structures security:
  - `optimizer_secure_view_merging=false`
    - Otherwise it is possible for the optimizer to create different execution plans for identical statements on identical objects issued from different user schemas
    - Alternative:
      Grant MERGE ANY VIEW privilege to subordinate users
    - See Note:468380.1

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Cascading View Issues - 10.2.0.x

- Optimizer sometimes does wrong rewrites with cascading views
  - Requirement:
    - "_push_join_predicate" is set to TRUE
  - Solution:
    - Patch on top of 10.2.0.4: **#7445276**
    - Or: `_optimizer_join_elimination_enabled=false`
  - Otherwise sometimes:
    - This Query: `select * from some_view where col1=10;`
      results in:
      - OK: `select * from (select * from base_table where col1=10);`
      - Not OK: `select * from (select * from base_table) where col1=10;`

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Costed query transformations since 10*g*

- Observation:
  Query execution or parse time problems after upgrade to 10/11*g*
  - Since 10*g* CBO has been added costed subquery unnesting and view merging functionality.
  - Can be disabled by:
    - `_optimizer_cost_based_transformation=off`

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CBO verifies more joins orders since 10*g*

- The CBO since 10*g* verifies more join orders to find out the least expensive one - this can sometimes lead to higher parse times
  - Remedy: **`_new_initial_join_orders=false`**
  - Example: observation for an explain plan:
    - Set OFE=920: Number of join permutations tried: 187
    - Set OFE=10203: Number of join permutations tried: 986

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PL/SQL cursors not cached ≥10.2.0.4

- Before 10.2.0.4 PL/SQL cursors will be cached automatically because of `OPEN_CURSORS`. Since 10.2.0.4 `SESSION_CACHED_CURSORS` has to be defined to ensure cursor caching for PL/SQL
  - Remedy: **`session_cached_cursors=500`**

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New behavior for datafile write errors

- Beginning with patch set 11.2.0.2 the behavior changed when a write error to ANY datafile happens:
  - By default this parameter is now TRUE:
    _DATAFILE_WRITE_ERRORS_CRASH_INSTANCE=TRUE
  - An I/O write error to a datafile will crash the instance in 11.2.0.2
    - See Bug 7691270 and MOS Note: 7691270.8
  - Setting _DATAFILE_WRITE_ERRORS_CRASH_INSTANCE=FALSE reverts to the "old" behavior meaning:
    - A write error to a datafile offlines the file if:
      - Database is in archivelog mode
      - Datafile does not belong to SYSTEM tablespace (this would initiate a SHUTDOWN ABORT)

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Table caching has changed ≥11.1.0.6

- Large tables most likely won't be cached for sequential FTS regardless of ALTER TABLE CACHE attribute
  - Remedy: set **_small_table_treshold**
  - Example:
    - `CREATE TABLE big_has_95000_blks(...);`
    - Force a preload:

```
ALTER SESSION SET "_small_table_threshold"=100000;
SELECT /*+FULL(a) */ ... FROM big_has_95000_blks a;
```

    - Now the table is in cache and will be kept there

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Bug 7596023

- ORA-7445 [kkqtutlGenRowid()+157]
  - Bug 7596023
  - Apply patch on top of 11.1.0.7
    (fixed in 11.1.0.7.2 and 11.2)

    or:

  - Workaround:
    - Set `"_optimizer_join_elimination_enabled"=false`
    - Disable the fix for bug 6167716 eg:
      Set `"_FIX_CONTROL"='6167716:OFF'`

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Bug 9411496

- If `cursor_sharing=similar`
- ORA-979: not a GROUP BY expression
  - **`select to_char(first_time, 'YYYYMMDD'), sum(blocks*block_size)`**
    `from v$archived_log`
    `group by to_char(first_time, 'YYYYMMDD')`
    `order by  to_char(first_time, 'YYYYMMDD');`

    ➔ `results with: ORA-979`
  - Bug 9411496
  - Fixed in 11.2.0.2
  - Possible workarounds (please use only ONE of these):
    - `optimizer_features_enable = '11.1.0.7'`
    - `"_optimizer_push_pred_cost_based" = false`
    - `"_optimizer_cost_based_transformation" = off`
    - Disable the fix for bug *5520732* eg:
      Set `"_FIX_CONTROL"='5520732:OFF'`

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DBMS_SQL got new security checks

- ORA-29471: „DBMS_SQL Access Denied“ After Upgrade
- Further information: Note:556301.1
  - DBMS_SQL has been recoded with some security checks in 11.1.0.6
  - The application must be recoded. For a temporary work around, a new parameter `security_level` can be added into `DBMS_SQL.OPEN_CURSOR`.
    - `security_level` specifies the level of security protection to enforce on the opened cursor. Valid security level values are 0, 1, and 2. When a NULL argument value is provided to this overload, as well as for cursors opened using the overload of o`pen_cursor` without the `security_level` parameter, the default security level value 1 will be enforced on the opened cursor.
      - *`Level 0` - allows all `DBMS_SQL` operations on the cursor without any security checks. The cursor may be fetched from, and even re-bound and re-executed, by code running with a different effective userid or roles than those in effect at the time the cursor was parsed. This level of security is off by default.*
      - *`Level 1` - requires that the effective userid and roles of the caller to `DBMS_SQL` for bind and execute operations on this cursor must be the same as those of the caller of the most recent parse operation on this cursor.*
      - *`Level 2` - requires that the effective userid and roles of the caller to `DBMS_SQL` for all bind, execute, define, describe, and fetch operations on this cursor must be the same as those of the caller of the most recent parse operation on this cursor.*

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Apply patch to 11.2.0.1/2 if you use XDB

- Due to bug10368698 the upgrade of the XDB Component will be slow if there are many objects in `RESOURCE_VIEW`
  - Bug 10368698 - perf issue with update resource_view during and after upgrading to 11.2.0.2
  - https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&doctype=PATCH&id=10368698.8

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Instant Client

- Universal. small footprint Oracle client
  - Works with OCI, OCCI, Pro*C, ODBC, JDBC, ODP.NET, ASP.NET, OLE DB and OO4O applications
  - No OUI Oracle Client installation necessary anymore
- Easy and simple deployment
  - Download it from OTN
  - Copy it to the target/client system(s)
  - Add its directory to **`PATH/LD_LIBRARY_PATH`** and set **`TNS_ADMIN`**
    - For ODBC run the provided batch script
  - Patching? Just deploy the current version
- More Information on OTN:
  http://www.oracle.com/technetwork/database/features/instant-client/index-100365.html

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Instant Client

- Instant Client Download:
  http://www.oracle.com/technetwork/database/features/instant-client/index-097480.html

  - Instant Client for Microsoft Windows (32-bit)
  - Instant Client for Microsoft Windows 64-bit Itanium
  - Instant Client for Microsoft Windows (x64)
  - Instant Client for Linux x86
  - Instant Client for Linux x86-64
  - Instant Client for Linux Itanium
  - Instant Client for Linux AMD64 (32-bit and 64-bit)
  - Instant Client for Linux on Power (32-bit)
  - Instant Client for Linux on Power (64-bit)
  - Instant Client for z/Linux
  - Instant Client for Mac OS X (Intel x86) (32-bit and 64-bit)
  - Instant Client for Mac OS X (PPC)
  - Instant Client for Solaris Operating System (SPARC) (64-bit)
  - Instant Client for Solaris Operating System (SPARC) (32-bit)
  - Instant Client for Solaris x86
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  - Instant Client for HP-UX PA-RISC (32-bit)
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  - Instant Client for HP-UX Itanium (64-bit)
  - Instant Client for HP-UX Itanium (32-bit)

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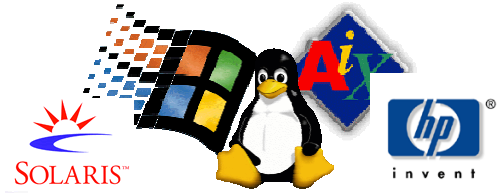
Instant Client



- Instant Client Packaging

Package Descriptions

Instant Client Package	Description	Notes
Basic	All files required to run OCI, OCCI, and JDBC-OCI applications	OCI OCCI JDBC
Basic Lite	Smaller version of the Basic, with only English error messages and Unicode, ASCII, and Western European character set support (10.2 only)	OCI OCCI JDBC
JDBC Supplement*	Additional support for XA, Internationalization, and RowSet operations under JDBC	JDBC
SQL*Plus*	Additional libraries and executable for running SQL*Plus with Instant Client	SQL*Plus 10.1 SQL*Plus 10.2
ODBC Supplement*	Additional libraries for enabling ODBC applications with Instant Client (Not all platforms)	ODBC
SDK*	Additional header files and an example makefile for developing Oracle applications with Instant Client	
ODAC*	Includes ODP.NET, Oracle Services for MTS, Oracle Providers for ASP.NET, Oracle Provider for OLE DB, and OO4O with Oracle Instant Client	

Optional packages are marked with a *.

- **Basic**: All files required to run OCI, OCCI, and JDBC-OCI applications (**46 MB**)
- **JDBC** Supplement: Additional support for XA, Internationalization, and RowSet operations under JDBC (**1.5 MB**)
- **SQL*Plus**: Additional libraries and executable for running SQL*Plus with Instant Client (**0.8 MB**)
- **SDK**: Additional header files and an example makefile for developing Oracle applications with Instant Client (**1 MB**)
- **ODBC**: Additional libraries for enabling ODBC applications (**0.7 MB**)
- **WRC**: Workload Replay Client used to replay workload for RAT's DB Replay Feature (**6 KB**)
- ´**Precompiler**: Additional files for "proc" binary and related files to precompile a Pro*C application and demo (**0.5 MB**)

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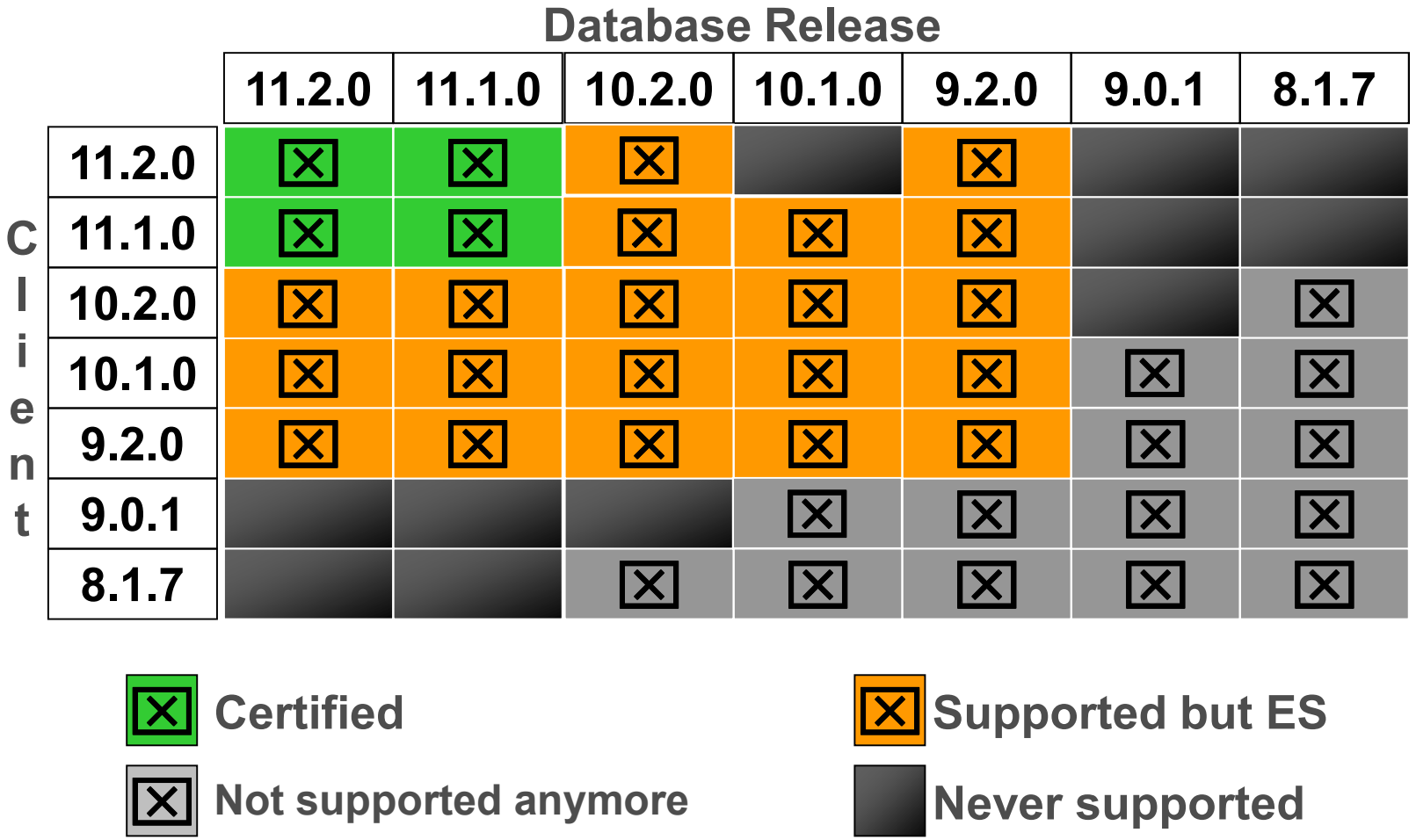
Clients & Net

- Client certification - Note:207303.1



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Clients & Net

- Database links
  - Only supported if matrix shows ‚Supported' in both directions
  - Not supported means: Use it on your own risk
- JDBC certification
  - Note:401934.1
- ODBC certification
  - Note:66403.1
  - ODBC Drivers as part of ODAC
    http://www.oracle.com/technetwork/topics/dotnet/downloads/index.html
- Forms/Reports certification
  - support.oracle.com ⇨ *Certifications* ⇨ Middleware ⇨ Developer Tools ⇨ Database & PLSQL ⇨ Oracle Forms

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32bit Clients in 11*g* Release 2

- `$ORACLE_HOME/lib32` does not exist in 11*g* Release 2
- 32-bit libraries are not being shipped with the 64-bit Oracle database server or 64-bit Oracle database client media
- Solution:
  - If you want 32-bit libraries, you need to install 32-bit client which is shipped as a separate media
  - Should be installed only into a new Oracle home
  - See Note:883702.1

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RMAN - Recovery Manager

- RMAN Compatibility Matrix
  - Note:73431.1
- Rules:
  - The RMAN executable version should be the same as the target database
  - The RMAN catalog schema version must be greater than or equal to the RMAN executable
    - Upgrade the catalog:

```
RMAN> upgrade catalog
```

  - The RMAN catalog is backwards compatible with target databases from earlier releases

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EBS DB Upgrade Best Practice

- Most Important: Read the interoperability note in MOS
  - Doc ID 1058763.1
  - Save a copy of the note locally so that you have a copy of the version you are working from in case it is updated

- Excellent resource
  - Steven Chan's blog (http://blogs.oracle.com/stevenChan/)

- See also:

- Migrating Oracle E-Business Suite to Exadata Database Machine Using Oracle Data Pump
  http://www.oracle.com/technetwork/database/features/availability/maa-ebs-dbm-datapump-167285.pdf
- Migrating Oracle E-Business Suite to Exadata Database Machine Using Transportable Tablespaces
  http://www.oracle.com/technetwork/database/features/availability/maa-ebs-exadata-xtts-321616.pdf
- Installing Oracle E-Business Suite Release 12 with Exadata Database Machine
  http://www.oracle.com/technetwork/database/features/availability/maa-ebs-dbm-fresh-install-249218.pdf

EBS DB Upgrade Best Practice

- Further important EBS Notes:
  - Note: 216205.1 - Database Initialization Parameters for Apps R11i
    https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&doctype=WHITE%20PAPER&id=216205.1

Upgrading your applications

- Compatibility Issues:
  - Check for reserved words
    - Appendix A, Upgrade Guide
  - Check for behaviour changes
    - Appendix A, Upgrade Guide
    - Upgrade Companion
  - Check for changes in the data dictionary
    - Appendix A, Upgrade Guide

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Upgrading your applications

- Reserved words check:

```
select ao.owner, ao.object_name, ao.object_type
  from all_objects ao, v$reserved_words osrw
 where ao.object_name = osrw.keyword
   and ao.owner not in ('SYS','PUBLIC','SYSMAN','XDB',
   'CTXSYS','SYSTEM','WMSYS', 'OWBSYS','ORDSYS','ORDDATA',
   'OUTLN','OLAPSYS','MDSYS','APEX_030200') order by 1, 2;

select atc.owner, atc.table_name, atc.column_name
  from all_tab_columns atc, v$reserved_words osrw
 where atc.column_name = osrw.keyword
   and atc.owner not in ('SYS','PUBLIC','SYSMAN','XDB',
   'CTXSYS','SYSTEM','WMSYS', 'OWBSYS','ORDSYS','ORDDATA',
   'OUTLN','OLAPSYS','MDSYS','APEX_030200') order by 1, 2;
```

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Upgrading your applications

- Precompiler and OCI applications:
  - Upgrading the Oracle Database Server software
    - If you do not change the client environment than you won't have to precompile, compile or relink
    - Database Server version should be identical or higher than client version
  - Upgrading the Oracle Client software
    - It is recommended that Oracle client software has the same release than the server
      - Dynamic Libraries: No relink required
      - Static Libraries: Need to be relinked always

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Upgrading your applications

- Precompiler and OCI applications:
  - Option 1: Leave the application unchanged
    - Don't upgrade the client installation
    - Simple and easy
  - Option 2: Precompile the application and change client
    - Recompile when you change the major release
    - You don't have to recompile for a patch release
  - Option 3: Change the application code to use 11g features
    - Most potential benefits
    - Most difficult option
    - Precompile, compile and relink

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Conversion between XE, SE and EE

- SE ⇨ EE see Note:117048.1
  - Take a full backup
  - Run `catalog.sql` and `catproc.sql` in the EE environment
- EE ⇨ SE see Note:139642.1
  - Only Export/Import with **`exp/imp`** or **`expdp/imdp`** will be supported
- XE ⇨ SE/SEone/EE
  - http://download.oracle.com/docs/cd/B28359_01/server.111/b28300/intro.htm#BABGDCDD
  - Use the DBUA to upgrade your XE database to Seone/SE/EE

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SYSAUX Tablespace in 11.2

Occupant name	Occupant description	Schema	Create	Drop	Move method
AO	Analytical Workspace Object	SYS			DBMS_AW.MOVE_AWMETA
AUDIT_TABLES	DB audit tables	SYS			DBMS_AUDIT_MGMT.move_dbaudit_tables
AUTO_TASK	Automated Maintenance Tasks	SYS			
EM	Enterprise Manager Repository	SYSMAN			emd_maintenance.move_em_tblspc
EM_MONITORING_USER	EM Monitoring User	DBSNMP	*catsnmp.sql*	catnsnmp.sql	
EXPRESSION_FILTER	Expression Filter System	EXFSYS			
JOB_SCHEDULER	Unified Job Scheduler	SYS			
LOGMNR	LogMiner	SYSTEM	*catlmnr.sql*	N/A	SYS.DBMS_LOGMNR_D.SET_TABLESPACE
LOGSTDBY	Logical Standby	SYSTEM	*catlsby.sql*	N/A	SYS.DBMS_LOGSTDBY.SET_TABLESPACE
ORDIM	Oracle Multimedia ORDSYS	ORDSYS	ordinst.sql	N/A	ordsys.ord_admin.move_ordim_tblspc
ORDIM/ORDDATA	Oracle Multimedia ORDDATA	ORDDATA	ordinst.sql	N/A	ordsys.ord_admin.move_ordim_tblspc
ORDIM/ORDPLUGINS	Oracle Multimedia ORDPLUGINS	ORDPLUGINS	ordinst.sql	N/A	ordsys.ord_admin.move_ordim_tblspc
ORDIM/SI_INFORMTN_SCHEMA	Oracle Multimedia SI_INFORMTN_SCHEMA	SI_INFORMTN_SCHEMA	ordinst.sql	N/A	ordsys.ord_admin.move_ordim_tblspc
PL/SCOPE	PL/SQL Identifier Collection	SYS			
SDO	Oracle Spatial	MDSYS	catmd.sql	N/A	MDSYS.MOVE_SDO
SM/ADVISOR	SM - Advisor Framework	SYS	*catadv.sql*	catnoadv.sql	
SM/AWR	SM - Automatic Workload Repository	SYS	*catawr.sql*	catnoawr.sql	
SM/OPTSTAT	SM - Optimizer Stats History	SYS	catost.sql	N/A	
SM/OTHER	SM - Other Components	SYS			
SMON_SCN_TIME	Transaction Layer – SCN to time mapping	SYS			
SQL_MANAGEMENT_BASE	SQL Management Base	SYS	catsmbvw.sql	N/A	
STATSPACK	Statspack Repository	PERFSTAT			Use export/import
STREAMS	Oracle Streams	SYS			
TEXT	Oracle Text	CTXSYS	catctx.sql	catnoctx.sql	DRI_MOVE_CTXSYS
TSM	Transparent Session Migration	TSMSYS	cattsm.sql	N/A	
ULTRASEARCH	Ultra Search	WKSYS	wk0setup.sql	wk0deinst.sql	MOVE_WK
ULTRASEARCH_DEMO_USER	Ultra Search Demo User	WK_TEST	wk0setup.sql	wk0deinst.sql	MOVE_WK
WM	Workspace Manager	WMSYS			DBMS_WM.move_proc
XDB	XDB	XDB	catqm.sql	catnoqm.sql	XDB.DBMS_XDB.MOVEXDB_TABLESPACE
XSAMD	OLAP Catalog	OLAPSYS			DBMS_AMD.Move_OLAP_Catalog
XSOQHIST	OLAP API History Tables	SYS			DBMS_XSOQ.OlapiMoveProc

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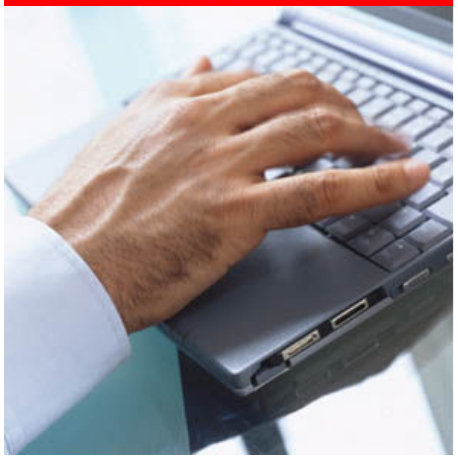
Agenda



- Preparation
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- Performance Testing
- Best Practices

Parameters
Processes
Miscellaneous
Tools
Automation
LOB & SecureFiles
Flashback
ADR
Compression

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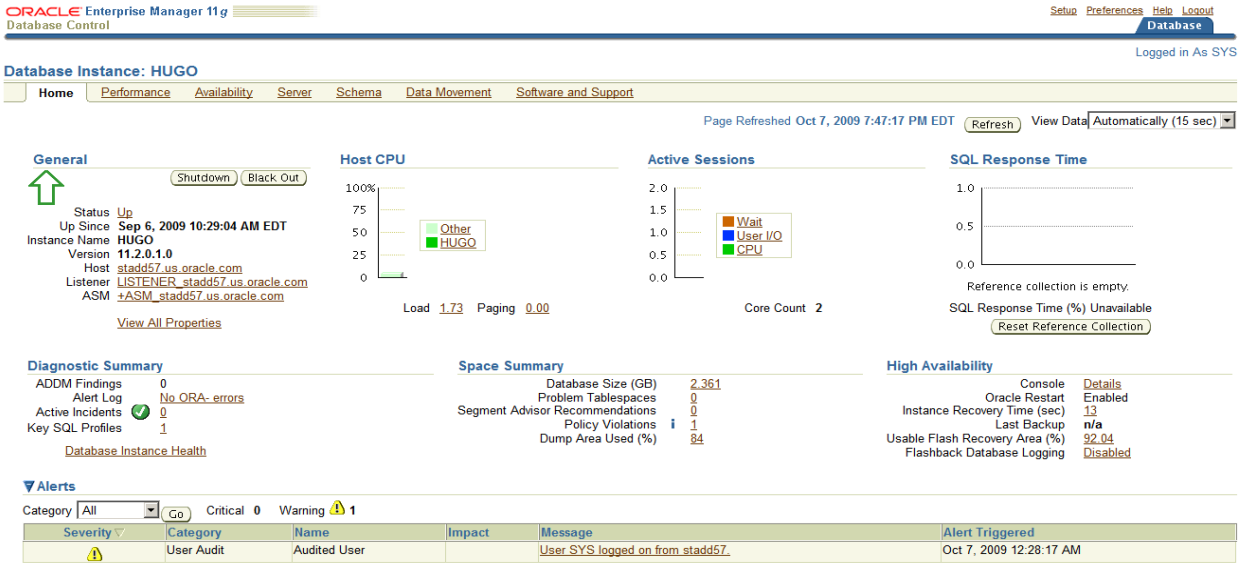
Enterprise Manager 11*g*

- Database Control for all database administration tasks
- 

- Grid Control as an IT system administration tool
  - Supports Oracle and non-Oracle IT infrastructures
  - Grid Control 11*g* has been available since 22-APR-2010
    - Be sure to upgrade the agents when you upgrade to a new version of GC!

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Enterprise Manager 11*g*

- Components
  - Database Control:
    Agent and standalone OC4J - thus no additional webserver needed
  - Grid Control:
    OMS, Management Agent and Repository Database
- Installation:
  - Database Control:
    Automatically done within the 11*g* database software installation
  - Grid Control:
    Separate download/DVD
- License:
  - Both products are included in any database license
  - Specific packs and plug-ins may be licensed additionally

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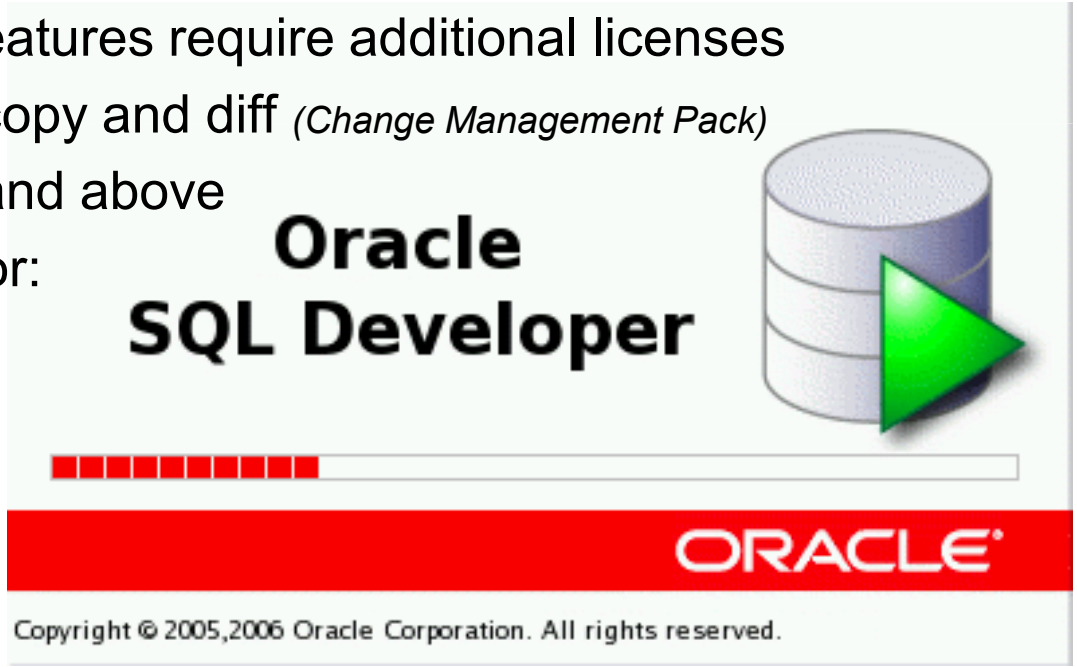
SQL Developer

- Developer tool at no extra cost
  http://www.oracle.com/technetwork/developer-tools/sql-developer/overview/index.html
- Key Features:
  - Excellent PL/SQL development and debugging
  - Extremely fast object browser
  - Base tool free, some features require additional licenses
    - Schema/database copy and diff *(Change Management Pack)*
  - Supports Oracle 9*iR2* and above
  - Migration workbench for:
  - Installed version:
    - 1.5.5
  - Current version (OTN):
    - 3.0.1



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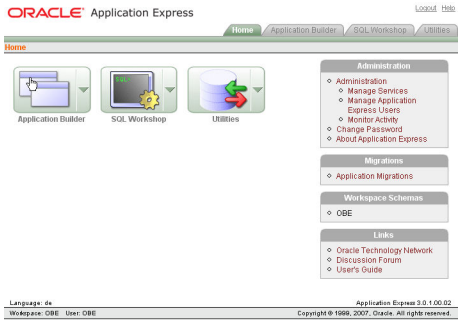
APEX



- APEX = Application Express = ex-HTMLDB
  - GUI development environment
  - Easy to use - wizard driven
  - Forms conversion assistant
- APEX is available by default
  - No additional installation or license necessary
  - Oracle Database 11.2 ships with APEX 3.2
    - No webserver necessary – XDB gateway used for http
  - APEX 4.0 available
    - APEX Listener
      http://www.oracle.com/technetwork/developer-tools/apex-listener/overview/index.html
- Two configuration steps:
  - `$ORACLE_HOME/apex/apxconf.sql`
  - `ALTER USER anonymous ACCOUNT UNLOCK;`

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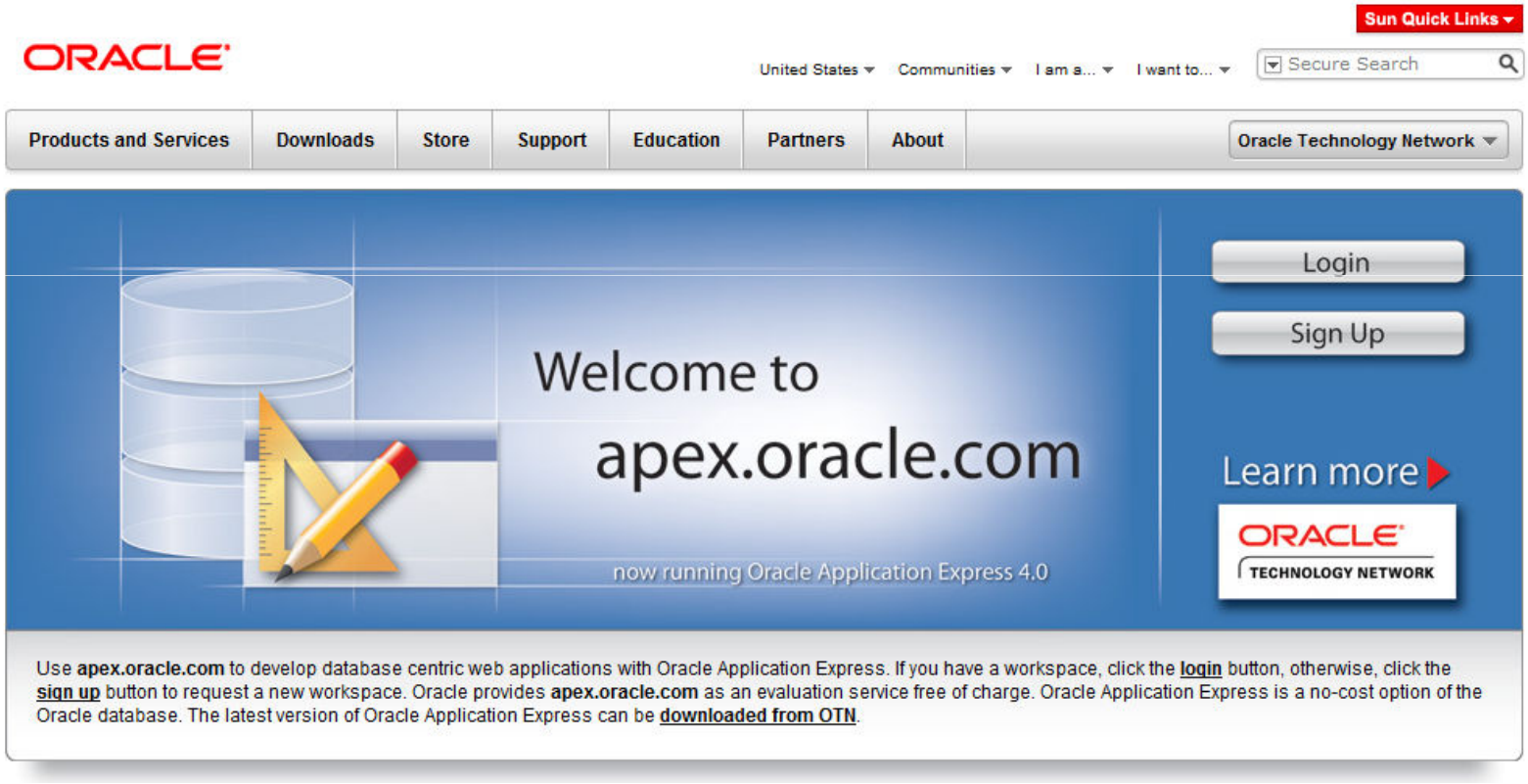
APEX

- Important APEX pages:
  http://www.oracle.com/technology/products/database/application_express/index.html
  http://apex.oracle.com



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APEX

- Could you remove *old* APEX FLOWS schemas after the upgrade?
  - See Note:555624.1 for how to remove old FLOWS schemas

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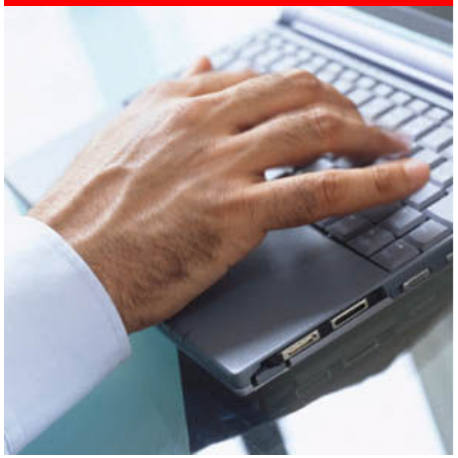
Agenda



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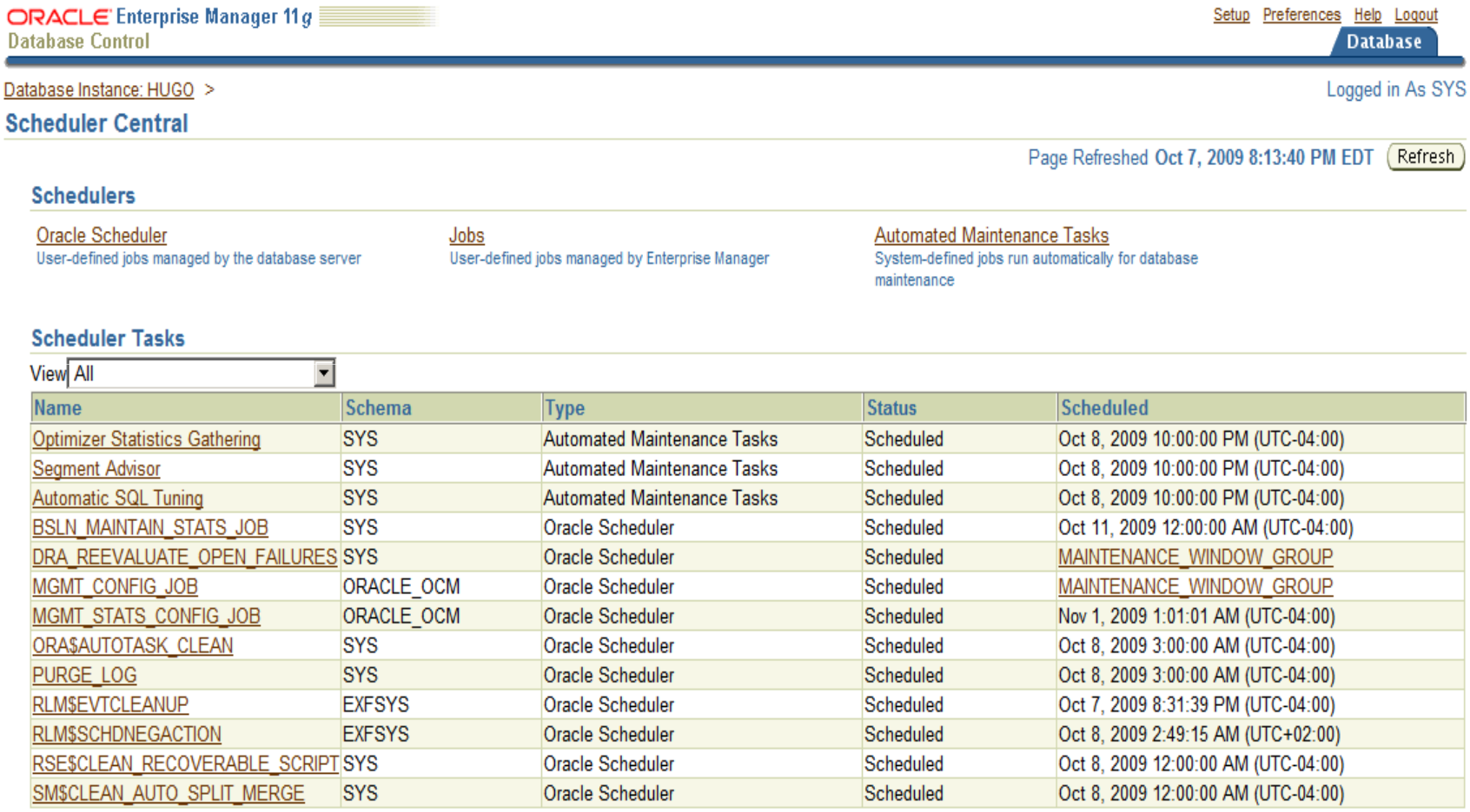
Automation in 11g

- EM: Scheduler Central



Name	Schema	Type	Status	Scheduled
Optimizer Statistics Gathering	SYS	Automated Maintenance Tasks	Scheduled	Oct 8, 2009 10:00:00 PM (UTC-04:00)
Segment Advisor	SYS	Automated Maintenance Tasks	Scheduled	Oct 8, 2009 10:00:00 PM (UTC-04:00)
Automatic SQL Tuning	SYS	Automated Maintenance Tasks	Scheduled	Oct 8, 2009 10:00:00 PM (UTC-04:00)
BSLN_MAINTAIN_STATS_JOB	SYS	Oracle Scheduler	Scheduled	Oct 11, 2009 12:00:00 AM (UTC-04:00)
DRA_REEVALUATE_OPEN_FAILURES	SYS	Oracle Scheduler	Scheduled	MAINTENANCE_WINDOW_GROUP
MGMT_CONFIG_JOB	ORACLE_OCM	Oracle Scheduler	Scheduled	MAINTENANCE_WINDOW_GROUP
MGMT_STATS_CONFIG_JOB	ORACLE_OCM	Oracle Scheduler	Scheduled	Nov 1, 2009 1:01:01 AM (UTC-04:00)
ORA$AUTOTASK_CLEAN	SYS	Oracle Scheduler	Scheduled	Oct 8, 2009 3:00:00 AM (UTC-04:00)
PURGE_LOG	SYS	Oracle Scheduler	Scheduled	Oct 8, 2009 3:00:00 AM (UTC-04:00)
RLM$EVTCLEANUP	EXFSYS	Oracle Scheduler	Scheduled	Oct 7, 2009 8:31:39 PM (UTC-04:00)
RLM$SCHDNEGACTION	EXFSYS	Oracle Scheduler	Scheduled	Oct 8, 2009 2:49:15 AM (UTC+02:00)
RSE$CLEAN_RECOVERABLE_SCRIPT	SYS	Oracle Scheduler	Scheduled	Oct 8, 2009 12:00:00 AM (UTC-04:00)
SM$CLEAN_AUTO_SPLIT_MERGE	SYS	Oracle Scheduler	Scheduled	Oct 8, 2009 12:00:00 AM (UTC-04:00)

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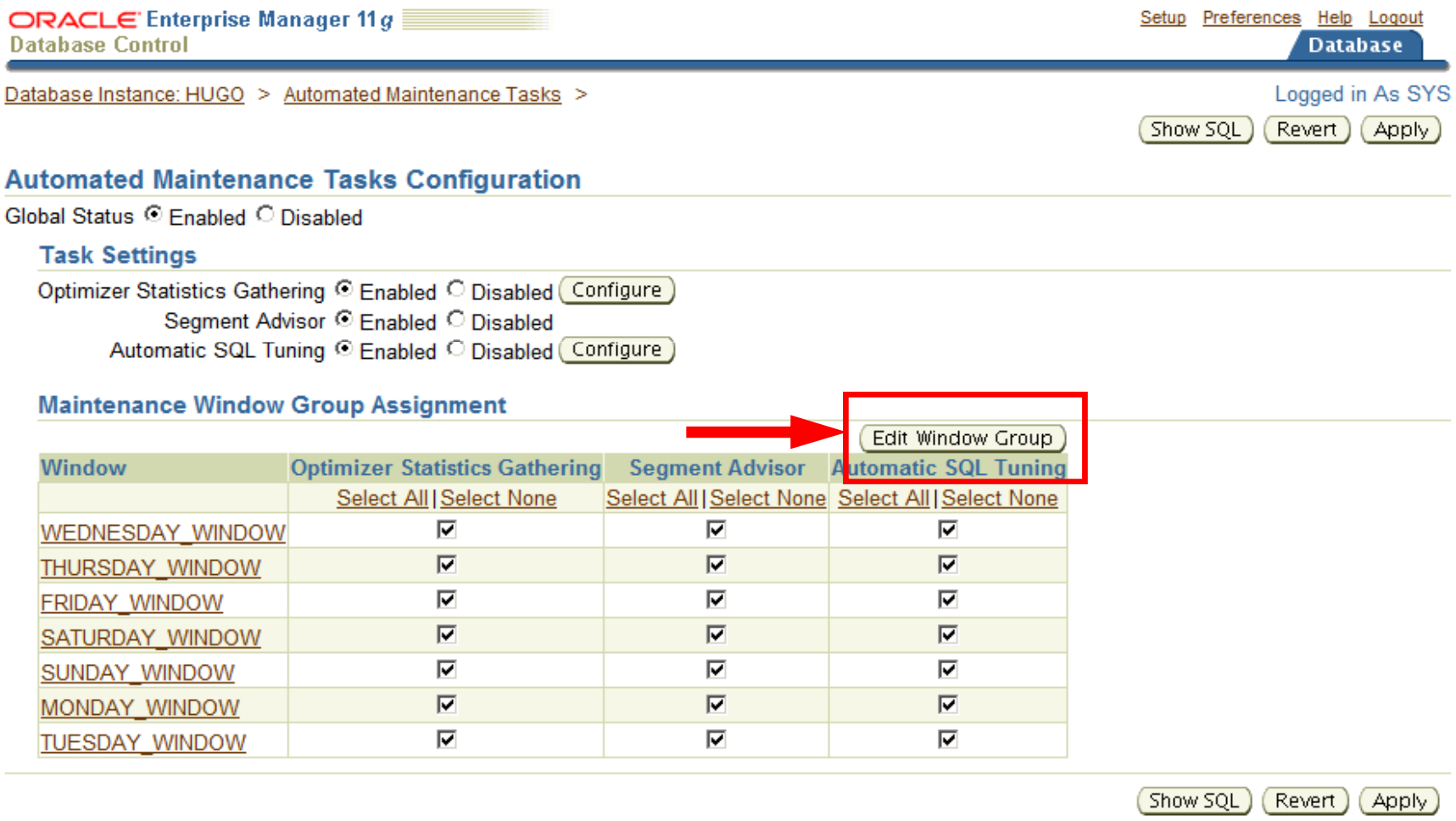
Automation in 11g

- Check the maintenance windows after upgrading



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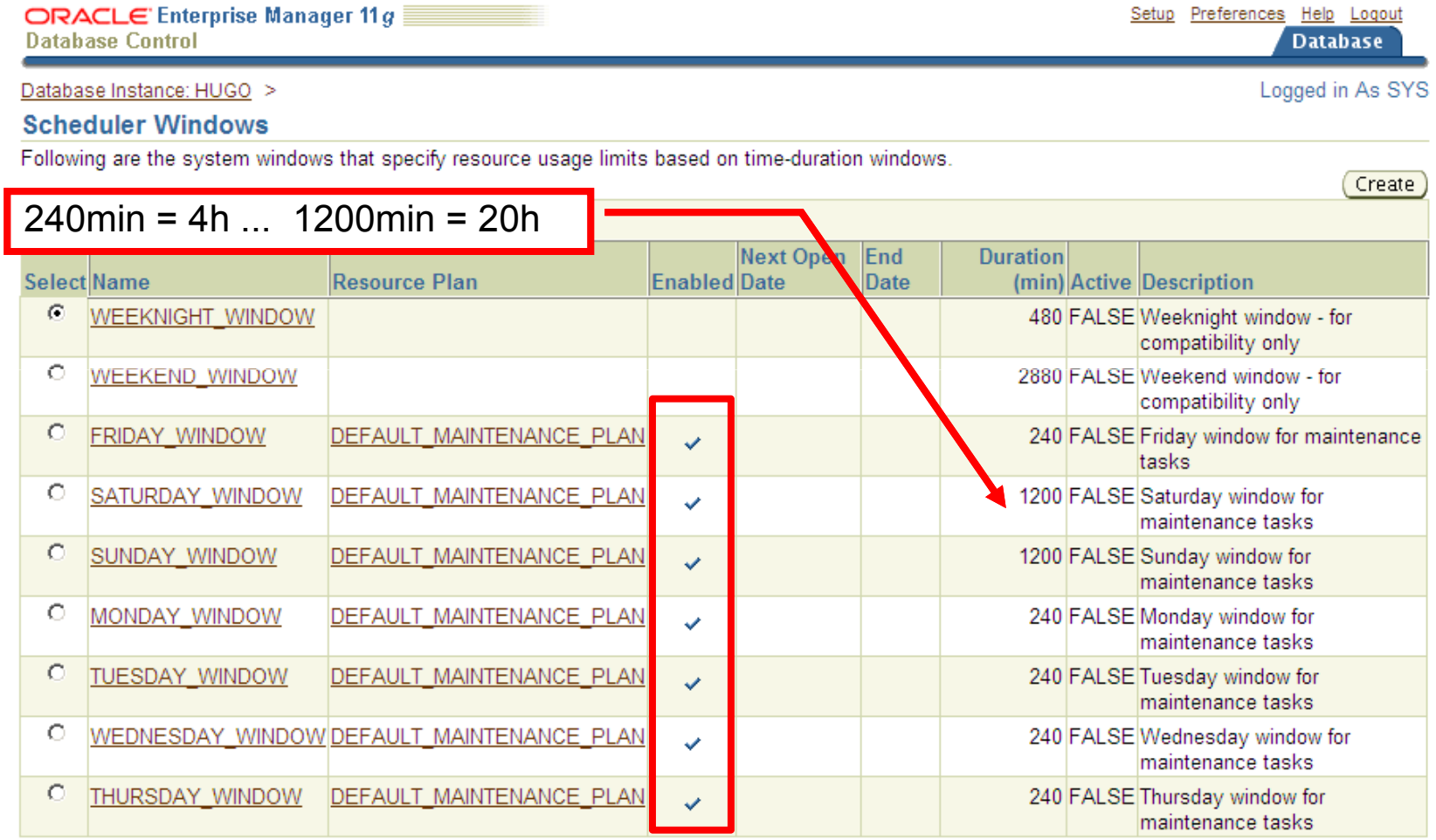
Automation in 11g

- Jobs – Default Maintenance Windows



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Automation in 11*g*

- Segment Advisor job identifies space to free up

Schedulers

Oracle Scheduler
User-defined jobs managed by the database server

Jobs
User-defined jobs managed by Enterprise Manager

Automated Maintenance Tasks
System-defined jobs run automatically for database maintenance

Scheduler Tasks

View All

Name	Schema	Type	Status	Scheduled
Optimizer Statistics Gathering	SYS	Automated Maintenance Tasks	Scheduled	Oct 8, 2009 10:00:00 PM (UTC-04:00)
Segment Advisor	SYS	Automated Maintenance Tasks	Scheduled	Oct 8, 2009 10:00:00 PM (UTC-04:00)
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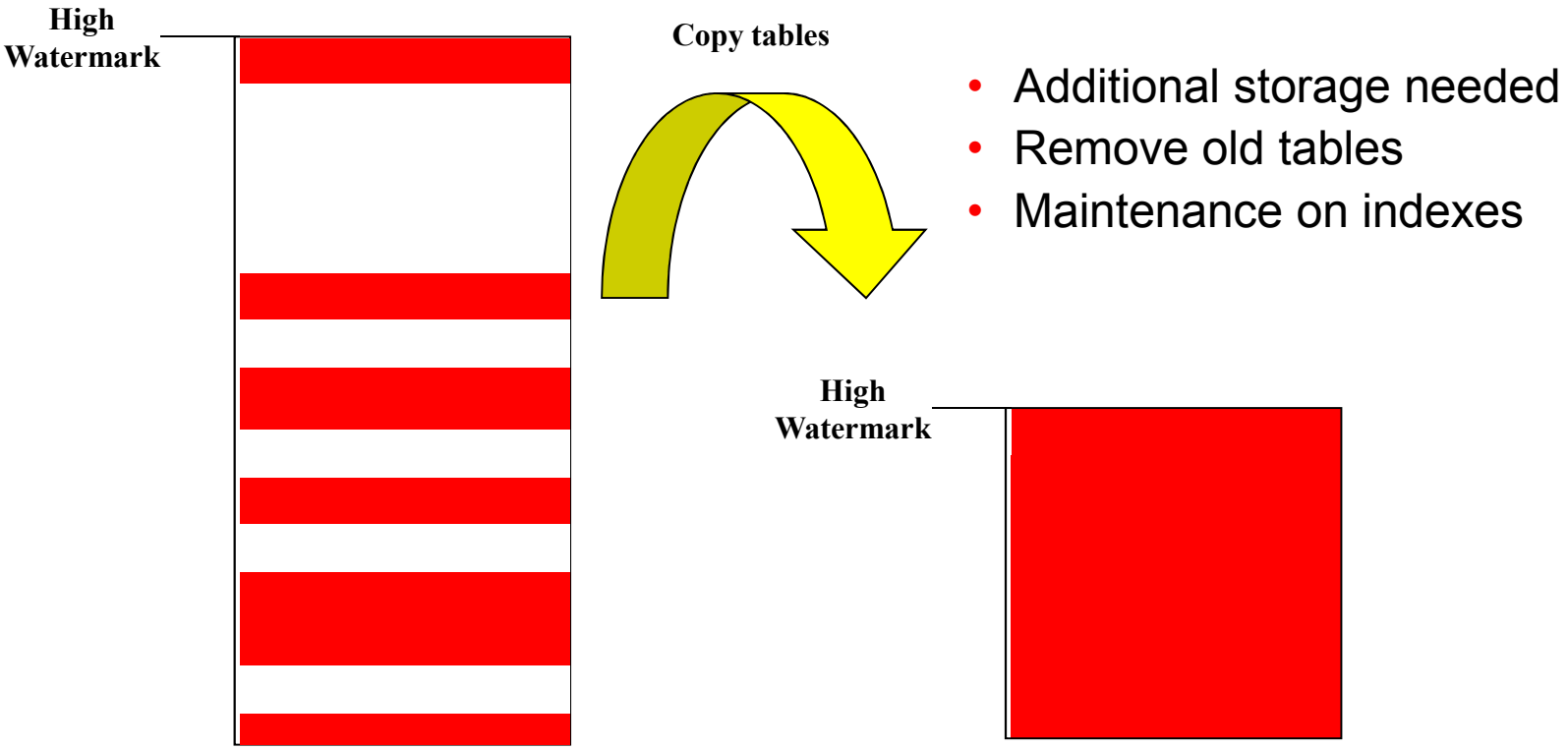
Mechanism: scale down tables in



- Additional storage needed
- Remove old tables
- Maintenance on indexes

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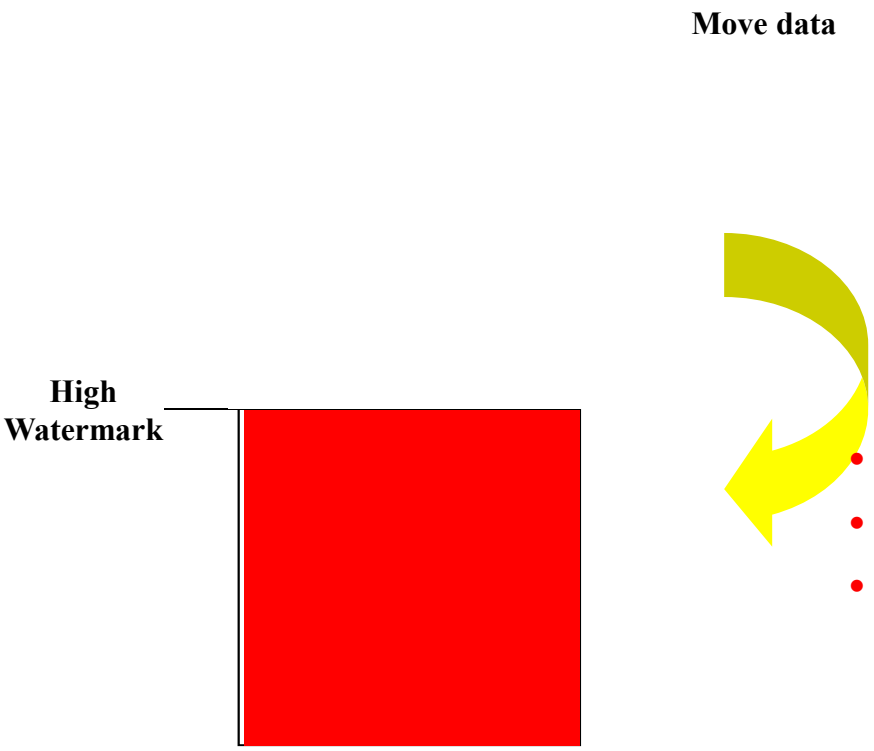
Mechanism: scale down tables in:



- Online
- Indexes are maintained
- Triggers won't be executed
  - But: TS must be ASSM
  - Exclusive Table Lock for HWM

```
ALTER TABLE <tablename> SHRINK SPACE;
```

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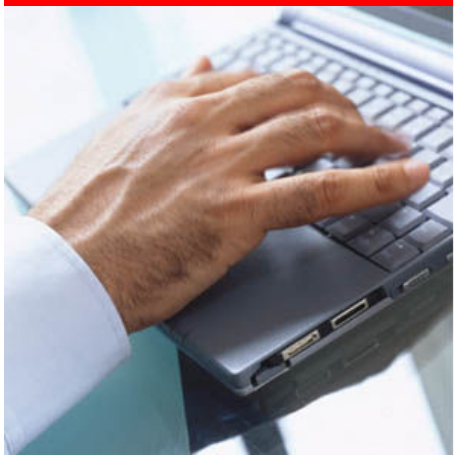
Agenda



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  - Flashback
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  - Compression
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- Best Practices

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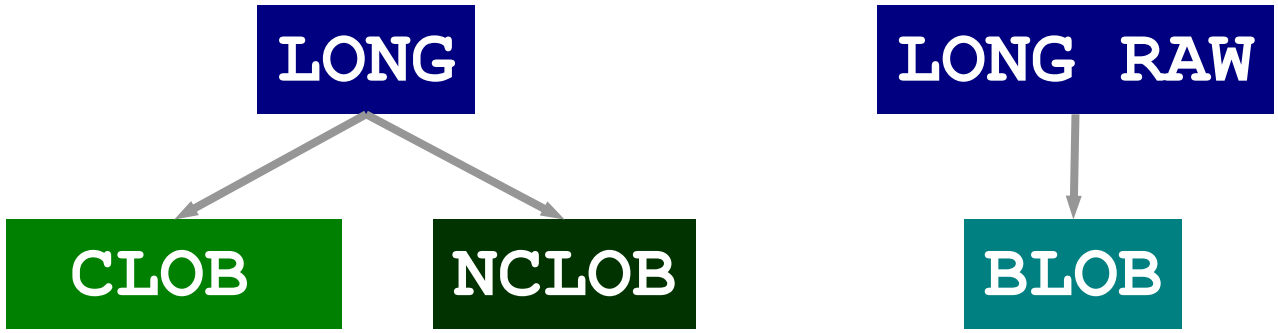
LONG ⇨ LOB Conversion

- LONG data type is still supported, but Oracle recommends conversion to LOB types



- Disadvantages of LONG:
  - Maximum number of LONG columns per table : 1
  - No replication possible with LONG und LONG RAW
  - Attention:
    - LONG ⇨ LOB conversion is irreversible

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LONG ⇨ LOB Conversion

- Conversion:

```
ALTER TABLE long_tab MODIFY ( long_col CLOB );
```

- Online Table Redefinition
  - Available for LONG/LOB since 10*g*
  - Package: DBMS_REDEFINITION
  - Regulation:
    - LONG ⇨ CLOB
    - LONG RAW ⇨ BLOB
  - Conversion is done implicitly
    - For scripted examples see: Note:251417.1, Note:556283.1 and Note:1012454.7
  - Advantage:
    Source table is available during the whole process

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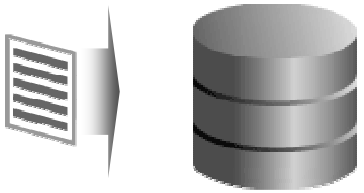
SecureFiles

- Securefiles = new LOB storage technology
  - Better performance
  - Additional features: deduplication, encryption
- Examples:



```
CREATE TABLE t1 (a CLOB) LOB(a) STORE AS SECUREFILE;

CREATE TABLE t2 (a CLOB) LOB(a) STORE AS SECUREFILE
    (DEDUPLICATE);

CREATE TABLE t3 (a CLOB ENCRYPT USING 'AES128')
    LOB(a) STORE AS SECUREFILE (CACHE);
```

  - Tablespace must be ASSM managed
  - Initialization parameter

```
DB_SECUREFILE = [NEVER | PERMITTED | ALWAYS | IGNORE]
  ➔ CREATE TABLE t1 (a CLOB); -- this will be a Securefile!!!
```

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SecureFiles

- Securefiles are fully transparent
  - Data type still a BLOB/CLOB
  - Definition per storage clause or controlled by init Parameter
  - No functional differences
    - Even *"deduplication"* is fully transparent for developers

- API access:
  PL/SQL (DBMS_LOB), JDBC, .NET, PHP, ...

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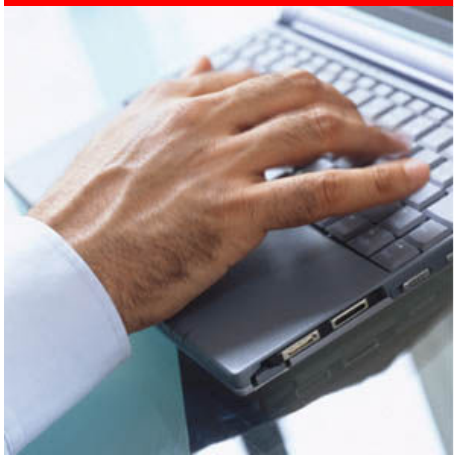
Agenda



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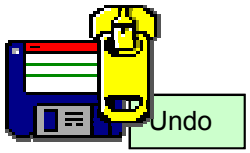
Flashback

- Different types of flashback and its sources (EE only!)
  - Flashback Query
  - Versions Query
  - Transaction Query
  - Flashback Table

  Undo ⇨ Enabled by default
  - Flashback Drop ⇨ Enabled by default
  - Flashback Database
    Flashback Logs ⇨ Has to be enabled
  - Total Recall
    Flashback Data Archive 

    ⇨ Has to be enabled

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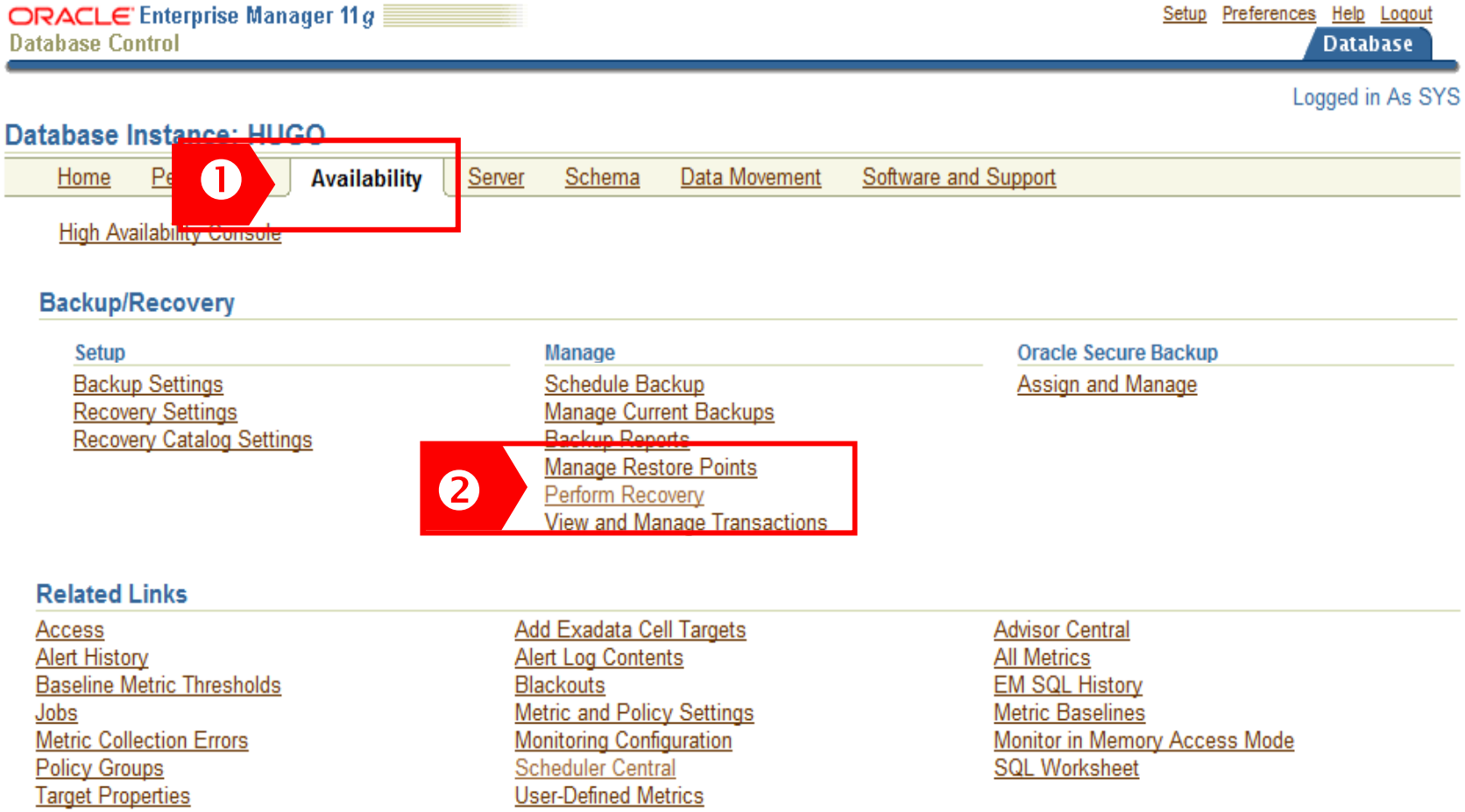
Flashback in EM

- Pretty well hidden ...:



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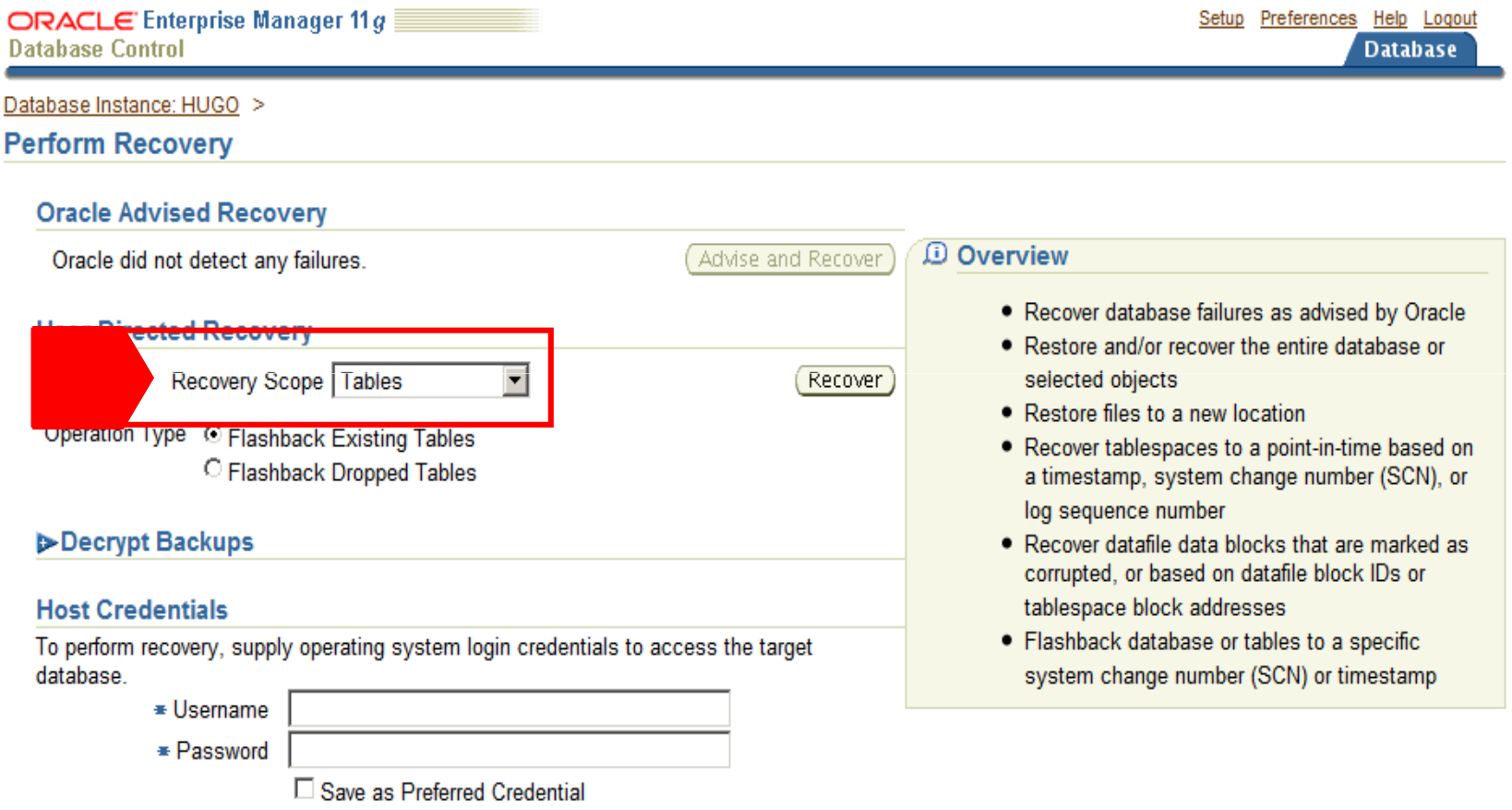
Flashback in EM

- Perform Recovery



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Restore Points

- Restore point – specifies a jump label
  - Named Restore Point
    - Similar to a bookmark
    - "Can be" - but no guarantee
    - Will be recorded to the control file

```
SQL> CREATE RESTORE POINT rpt;
SQL> FLASHBACK DATABASE TO RESTORE POINT rpt;
```

  - Guaranteed Restore Point
    - Similar to storage snapshots
    - Overrides the FLASHBACK_RETENTION_TARGET
    - Attention: A guarantee restore point can stop the whole database 😐

```
SQL> CREATE RESTORE POINT grpt
                GUARANTEE FLASHBACK DATABASE;
SQL> FLASHBACK DATABASE TO RESTORE POINT grpt;
```

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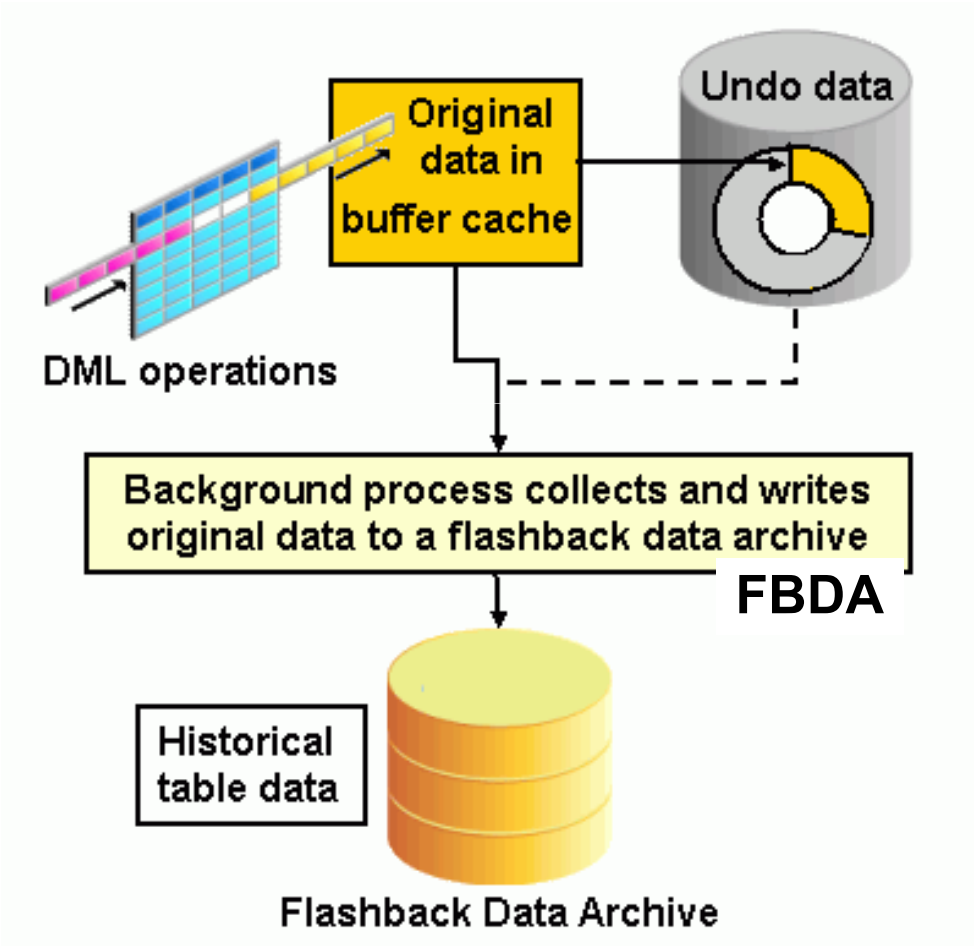
Flashback Data Archive - Total Recall

- How does it work?
  - Background process FBDA will track data changes (only UPDATEs and DELETEs) on monitored tables in the Flashback Data Archive (asynchronous)
  - Data gets extracted from undo information
  - Default capture interval: 5min
  - Capture interval will be changed automatically upon system work load
  - *Licensable option*



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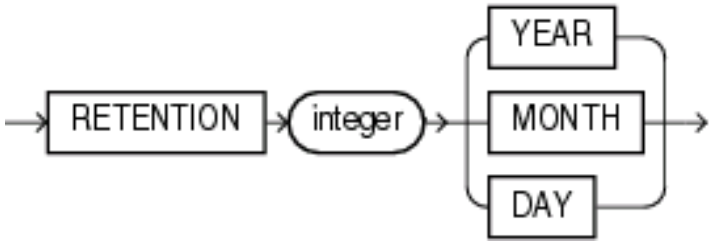
Flashback Data Archive - Total Recall

- Requirements:
  - Tablespace for FBDA has to be ASSM managed
  - Ideally separate tablespaces get created for the flashback data archives and reside on cheaper storage for cost efficiency
- Create a flashback data archive:

```
CREATE FLASHBACK ARCHIVE fda1
  TABLESPACE fda
  RETENTION 1 year;
```

- 

- Switch on flashback archiving for a specific object:

```
ALTER TABLE t1 FLASHBACK ARCHIVE fda1;
```

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Flashback Data Archive - Total Recall

- Behind the scenes:
  - In tablespace *fda* some structures will be created:

```
NAME                           TYP
------------------------------ -----------------
SYS_FBA_DDL_COLMAP_23107       TABLE
SYS_FBA_HIST_23107             TABLE PARTITION
SYS_FBA_TCRV_23107             TABLE
SYS_FBA_TCRV_IDX_23107         INDEX
```

    - 23107 is the OBJECT_ID of the table getting monitored/archived
  - Tracks the changes
  - If the defined retention is reached the required data will be deleted automatically
  - Absolutely transparent - no changes to any application necessary
  - Partitioning happens automatically

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Flashback Data Archive - Total Recall

- Is it possible to change data in the FDA?
  - Data will be stored such as:

```
ROWID                 STARTSCN     ENDSCN O       COL1
------------------ ---------- ---------- - ----------
AAAFplAAGAAAAAVAAA    1114797    1115141 I          1
AAAFplAAGAAAAAVAAB    1114797    1115141 I          2
AAAFplAAGAAAAAVAAC    1114797    1115141 I         23
AAAFplAAGAAAAAVAAD    1114797    1115141 I         24
AAAFplAAGAAAAAVAAE    1114797    1115141 I         25
AAAFplAAGAAAAAVAAF    1115141    1116039 U          2
...
```

  - Data can‘t be manipulated:

```
SQL> update SYS_FBA_HIST_23107 set col1=col1-1;
update SYS_FBA_HIST_23107 set col1=col1-1
       *
ERROR at line 1:
ORA-55622: DML, ALTER and CREATE UNIQUE INDEX operations are
not allowed on table "SYS"."SYS_FBA_HIST_23107"
```

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Flashback Data Archive - Total Recall

- How to access the historical data?
  -

```
SELECT * FROM t1
  AS OF TIMESTAMP '27-AUG-07 2:15:00pm';

      COL1
----------
         1
         2
        23

SELECT * FROM t1
  AS OF TIMESTAMP '14-SEP-08 2:30:00pm';

      COL1
----------
         2
         3
        24
```

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Flashback Data Archive - Total Recall

- 11.1 only: Switch off background process FBDA in 11*g*?
  - ```
    SQL> ALTER SYSTEM SET
         "_disable_flashback_archiver"=1
         scope=spfile;

    SQL> STARTUP FORCE

    $ ps -ef | grep fbda
    ```

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    ```

Flashback Data Archive – New in 11.2

- Most DDL commands on tables now supported
  - Add, Drop, Rename, Modify Column
  - Drop, Truncate Partition
  - Rename, Truncate Table
  - Add, Drop, Rename, Modify Constraint
- Disassociate and associate PL/SQL procedures can be used to temporarily disable Total Recall on specified tables
  - `DBMS_FLASHBACK_ARCHIVE.DISASSOCIATE_FBA`
  - `DBMS_FLASHBACK_ARCHIVE.REASSOCIATE_FBA`

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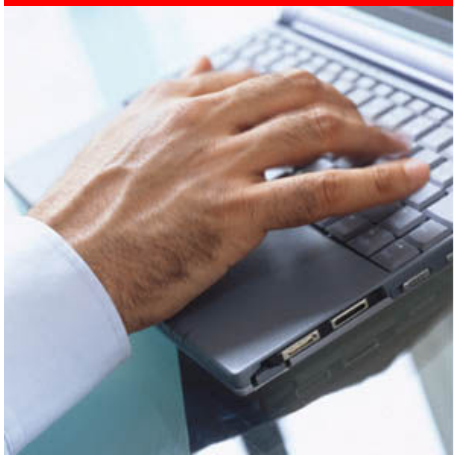
Agenda



- Preparation
- Installation
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- News and Task List
  - Parameters
  - Processes
  - Miscellaneous
  - Tools
  - Automation
  - LOB & SecureFiles
  - Flashback
  - ADR
  - Compression
- Diagnostics & Tuning
- Performance Testing
- Best Practices

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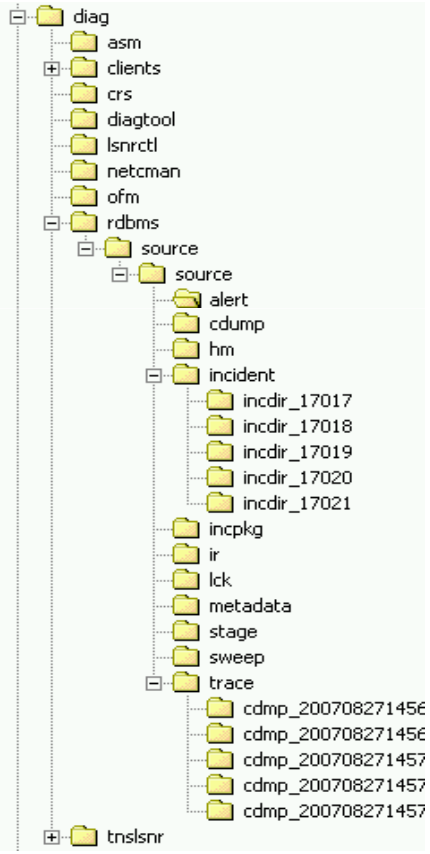
Automatic Diagnostic Repository

- ADR: systemwide logging and tracing directory
  - Set via `diagnostic_dest` parameter
  - Default: `ORACLE_BASE`



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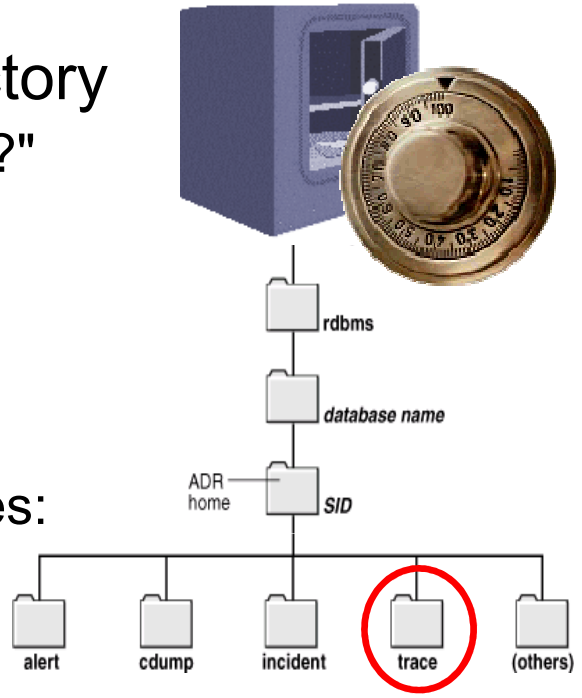
Automatic Diagnostic Repository

- ADR: systemwide logging/tracing directory
  - "Oh ... my alert.log is now in XML format ...?"
  - No panic:
    - Files are still kept also in text mode
    - There are two very comfortable interfaces:
      - **`adrci`**
      - EM interface
  - Error categories based on ITIL standards:
    - Problem
      Critical error such as ORA-600, ORA-7445, ORA-4031 ...
    - Incident
      Singular error - if it gets raised more often it'll become a PROBLEM!!



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Automatic Diagnostic Repository

- V$DIAG_INFO:

```
SQL> SELECT name, value FROM v$diag_info;

NAME                      WERT
------------------------- ----------------------------------------------
Diag Enabled              TRUE
ADR Base                  /u01/orabase
ADR Home                  /u01/orabase/diag/rdbms/v11201/V11201
Diag Trace                /u01/orabase/diag/rdbms/v11201/V11201/trace
Diag Alert                /u01/orabase/diag/rdbms/v11201/V11201/alert
Diag Incident             /u01/orabase/diag/rdbms/v11201/V11201/incident
Diag Cdump                /u01/orabase/diag/rdbms/v11201/V11201/cdump
Health Monitor            /u01/orabase/diag/rdbms/v11201/V11201/hm
Default Trace File        /u01/orabase/diag/rdbms/v11201/V11201/trace/V112
Active Problem Count      1
Active Incident Count     13
```

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Automatic Diagnostic Repository

- **adrci**

```
ADRCI: Release 11.1.0.7.0 - Production on Mon Apr 27 16:58:37 2009

Copyright (c) 1982, 2007, Oracle.  All rights reserved.

ADR base = "c:\oracle"
adrci> help | help extended
```

  - Step 1: Check and set ADRCI homes
    - **adrci> show home**
    - **adrci> set home** /diag/rdbms/v11201/V11201
  - Step 2: Define the editor, e.g.:
    - **adrci> set editor uedit32**
  - Step 3: Check alert.log, problems and incidents
    - **adrci> show alert -tail 50 -f**
    - **adrci> show problem**
    - **adrci> show incident**

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Automatic Diagnostic Repository

- **`adrci`**
  - Helpful notes:
    - Note: 443529.1
      11g Quick Steps to Package and Send Critical Error Diagnostic Information to Support
    - Note:738732.1
      ADR Different Methods to Create IPS Package
    - Note: 564269.1
      Retention Policy for ADR Incidents
      - SHORTP_POLICY:
        Used to purge information that has a short life.
        Default: 720 [hours] => 30 days
        Applies to: `TRACE, CDUMP, UTSCDMP, IPS`
      - LONGP_POLICY:
        To purge ADR contents that have a long life.
        Default: 8760 [hours] => 365 days
        Applies to: `ALERT, INCIDENT, SWEEP, STAGE, HM`

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Automatic Diagnostic Repository

- **adrci**: Trace file housekeeping

```
/* Check the current settings for retention policies */

adrci> show control

/* Change the retention policies */

adrci> set control (SHORTP_POLICY = 96)
adrci> set control (LONGP_POLICY = 240)

adrci> help purge

Usage: PURGE [[-i <id1> | <id1> <id2>] |
[-age <mins> [-type ALERT|INCIDENT|TRACE|CDUMP|HM|UTSCDMP]]]:

Purpose: Purge the diagnostic data in the current ADR home. If no option is specified, the
default purging policy will be used.

Options:
[-i id1 | id1 id2]: Users can input a single incident ID, or a range of incidents to purge.

[-age <mins>]: Users can specify the purging policy either to all
the diagnostic data or the specified type. The data older than <mins> ago will be purged

[-type ALERT|INCIDENT|TRACE|CDUMP|HM|UTSCDMP]:
Users can specify what type of data to be purged.
```

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Automatic Diagnostic Repository

- **`adrci`**: alert.log housekeeping

```
/* Delete the whole alert.log */

adrci> purge -age 0 -type alert


/* Delete traces older than 120 minutes*/

adrci> purge -age 120 -type trace
```

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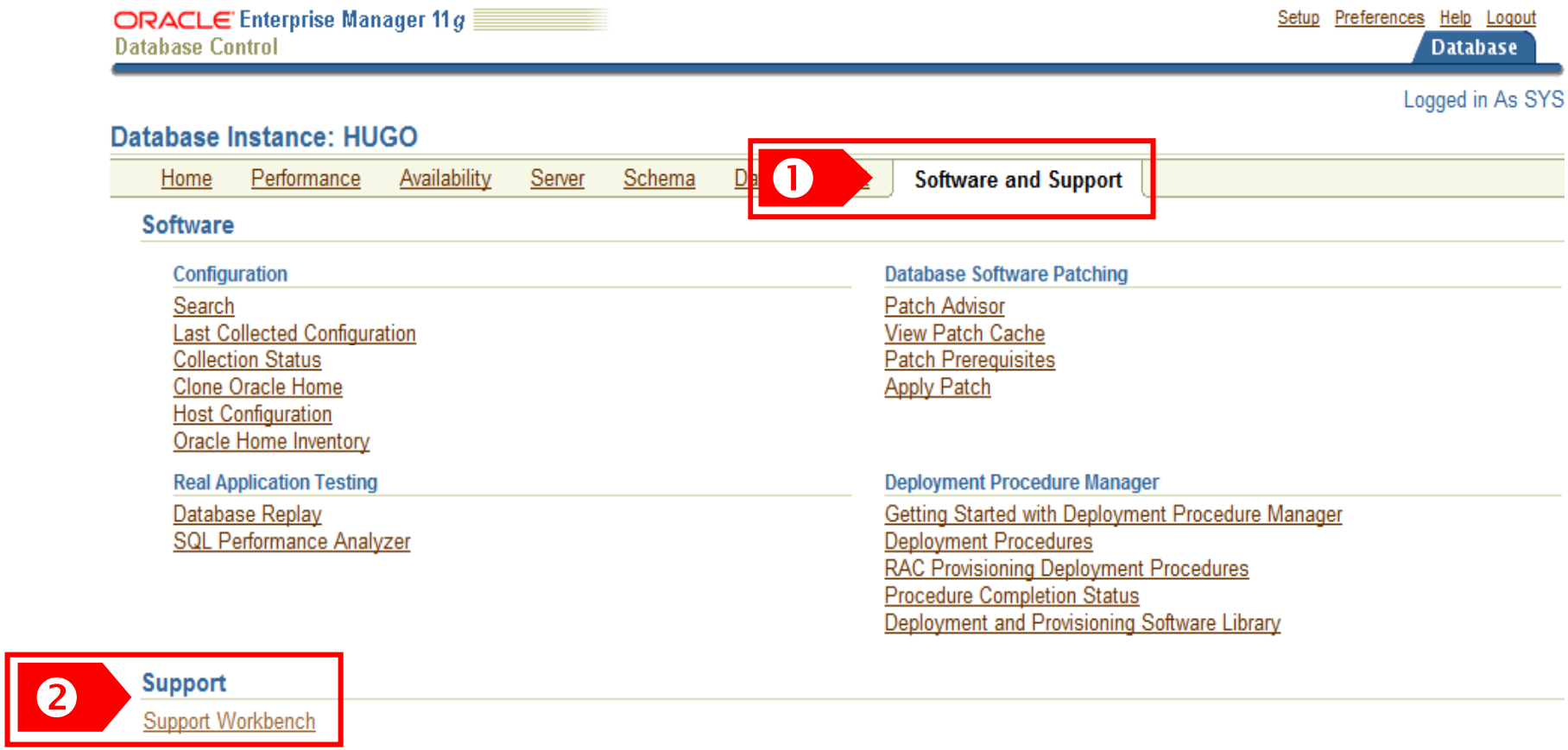
Automatic Diagnostic Repository

- Support Workbench



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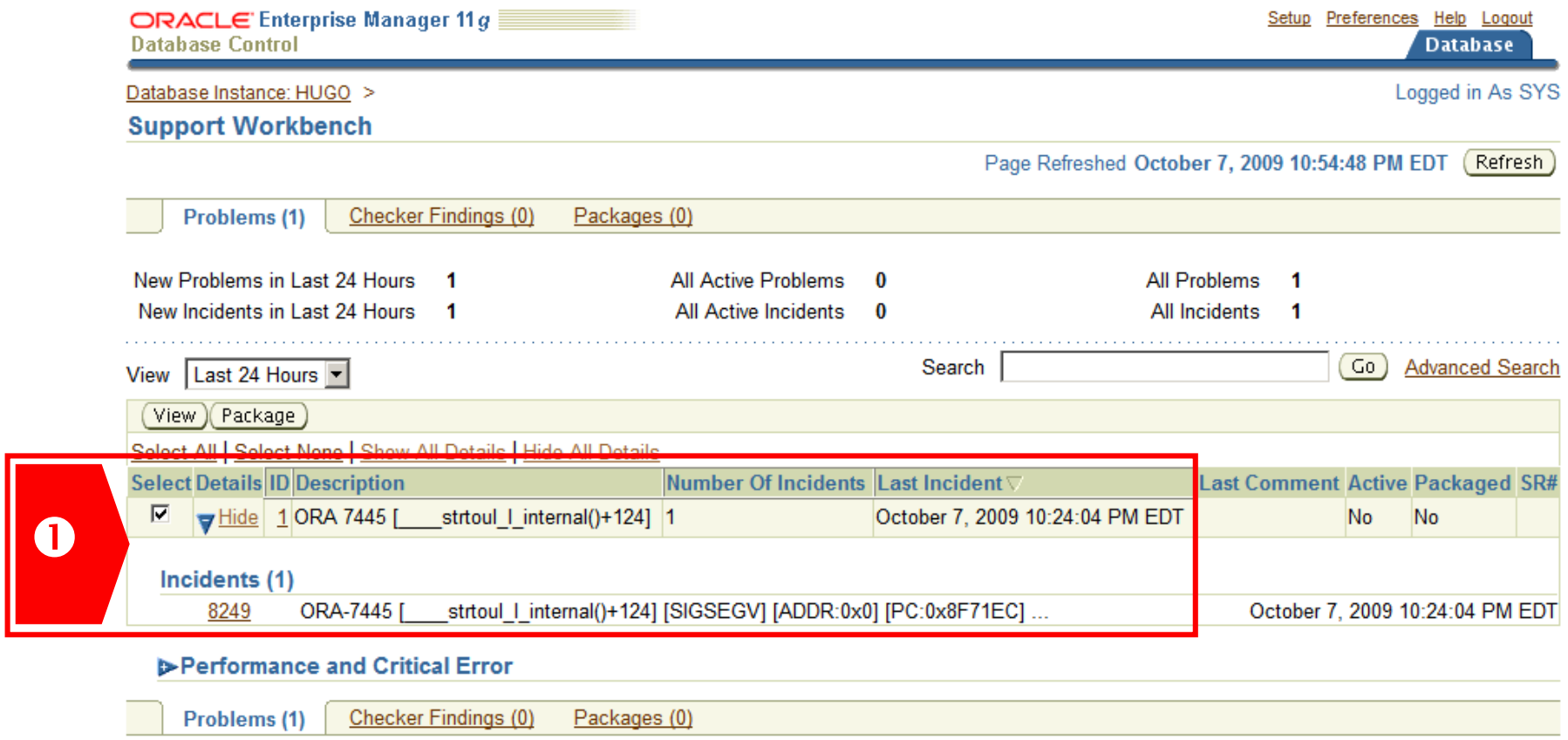
Automatic Diagnostic Repository

- Support Workbench – Any problems?



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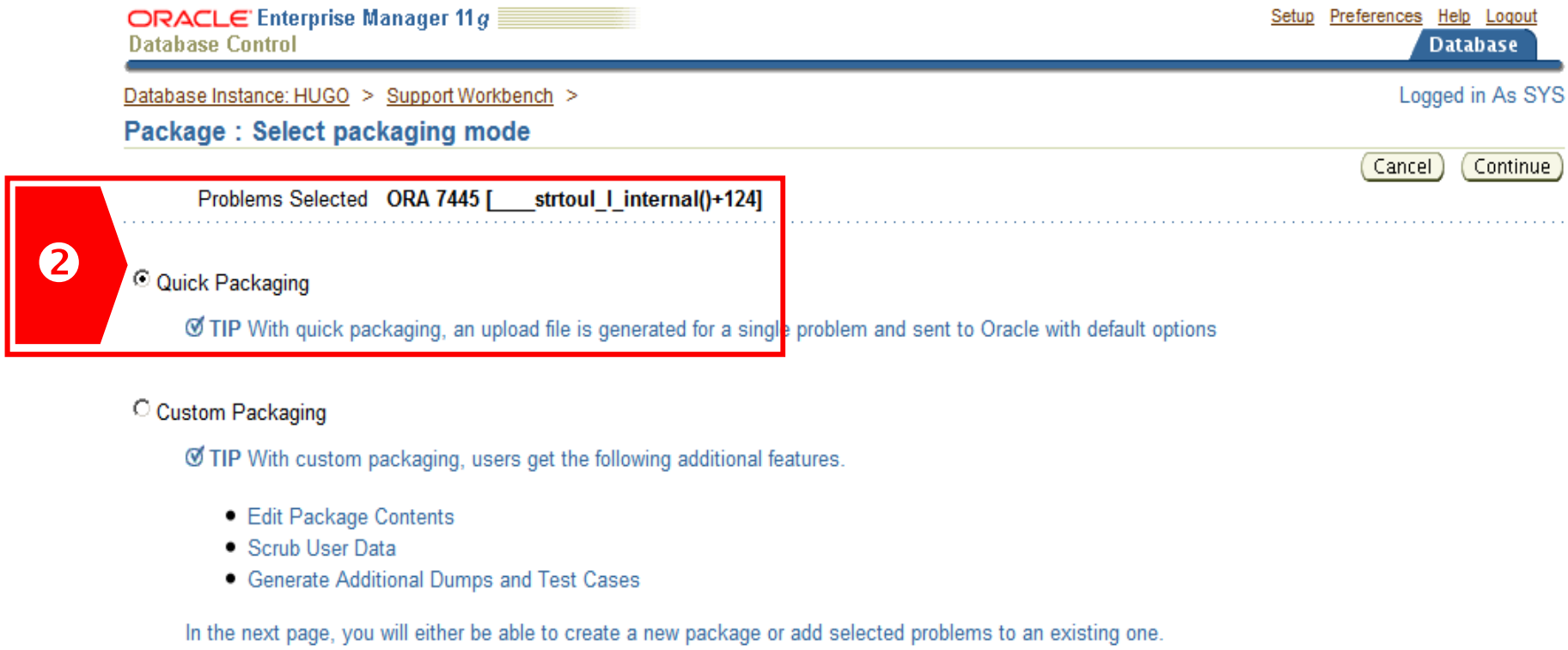
Automatic Diagnostic Repository

- Support Workbench – Package the problem



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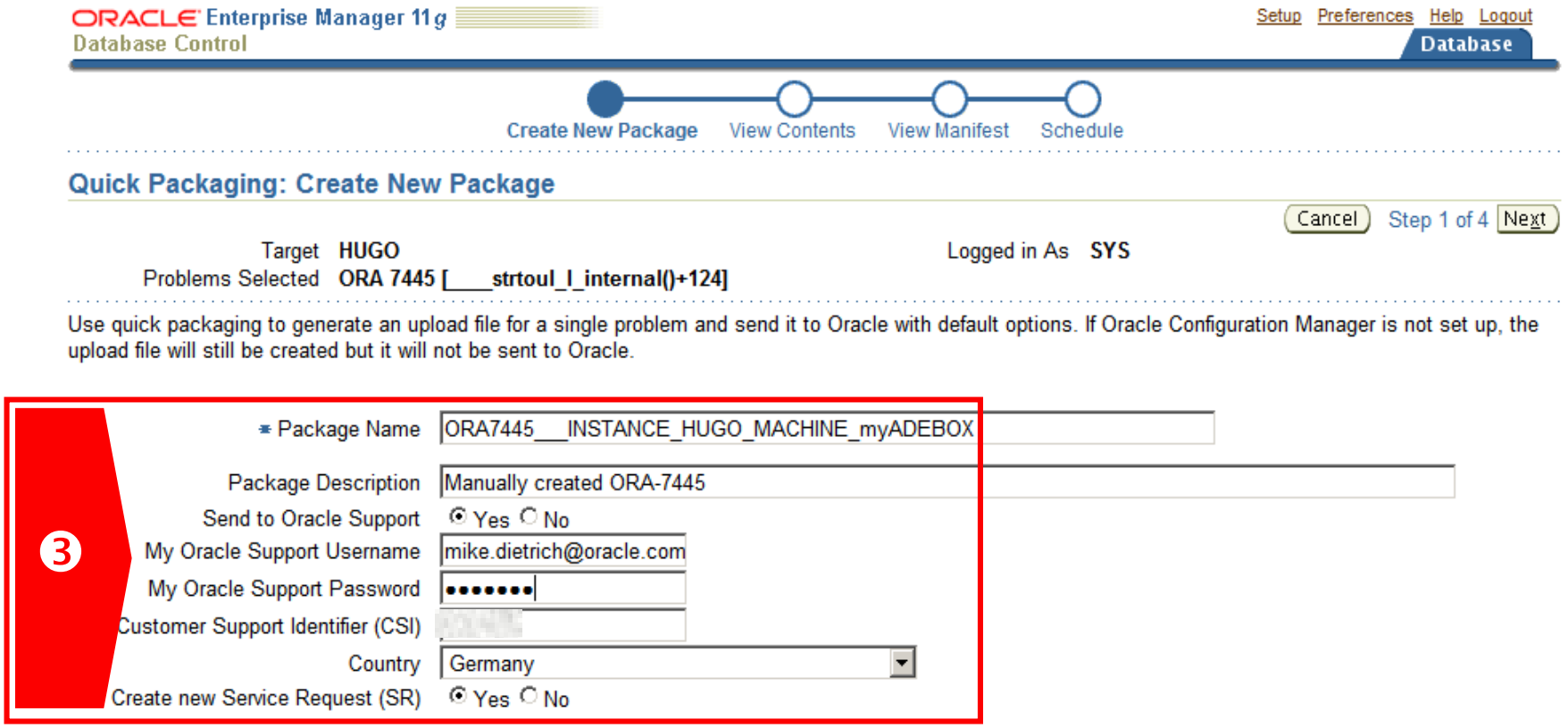
Automatic Diagnostic Repository

- Support Workbench – Metalink credentials



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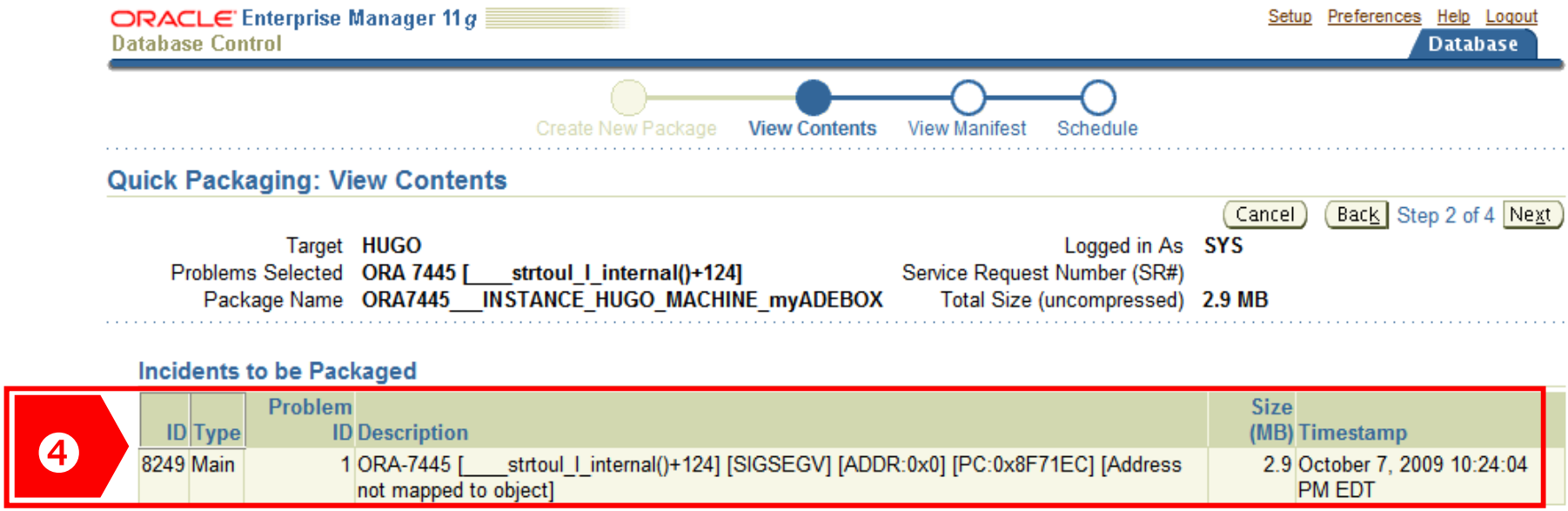
Automatic Diagnostic Repository

- Support Workbench – Problem is packaged



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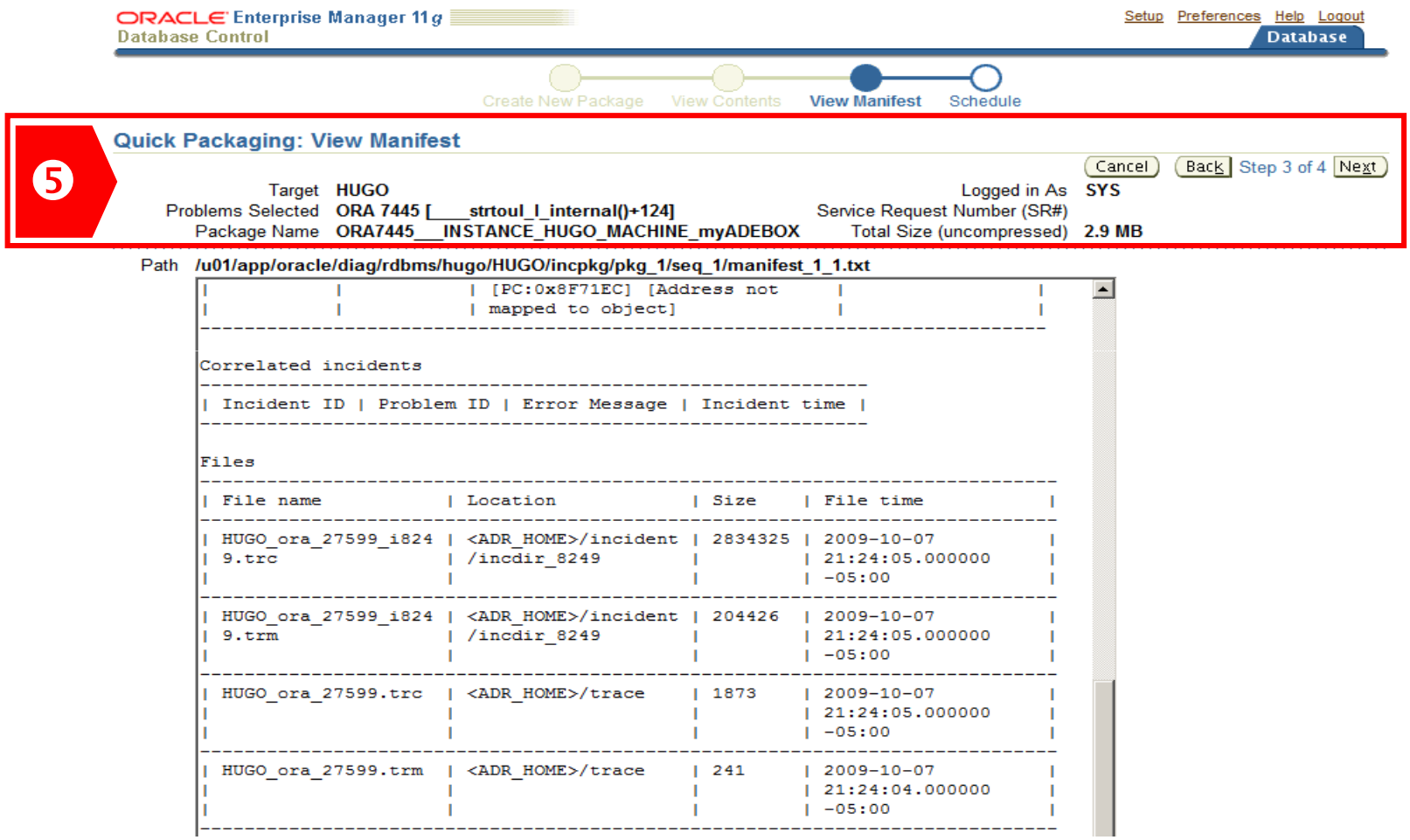
Automatic Diagnostic Repository

- Support Workbench – View contents



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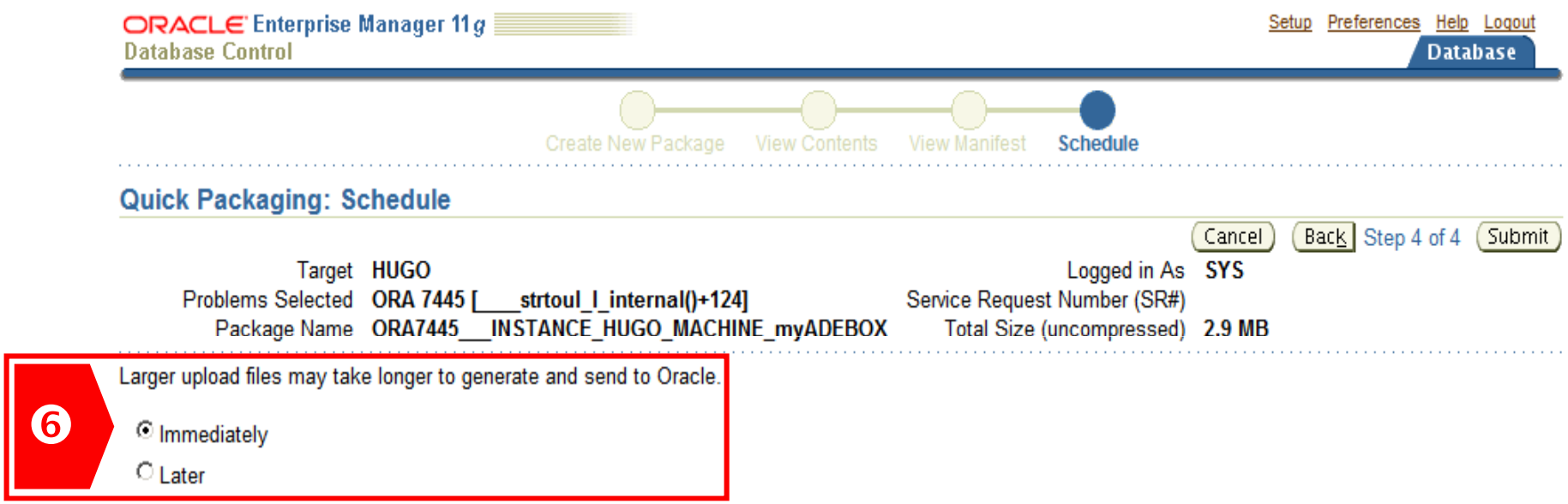
Automatic Diagnostic Repository

- Support Workbench – Upload it to Oracle Support



Please note:
Opening an SR on MyOracleSupport directly with Database/Grid Control requires the use of OCM (Oracle Configuration Manager)

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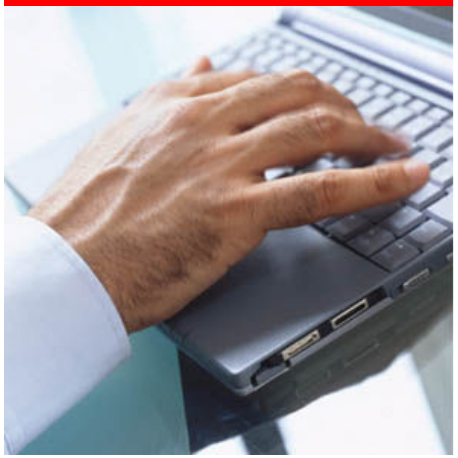
Agenda



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Automation
LOB & SecureFiles
Flashback
ADR
Compression

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Compression

- Index compression available since 8*i*
- Table compression available since 9.2
  - Designated for DWH
  - Direct path and bulk `INSERTs, CREATE TABLE .. AS SELECT`
  - Didn't work for `INSERT/UPDATE/DELETE`
- Before 11*g* syntax:

```
CREATE TABLE sales_history… COMPRESS
```

- New 11*g* syntax:

```
CREATE TABLE sales_history…
  COMPRESS BASIC
```

  - *BASIC has superseded the clause FOR DIRECT_LOAD OPERATIONS in 11.2*

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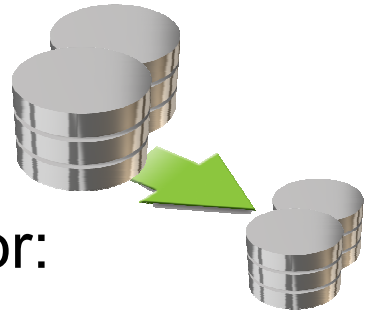
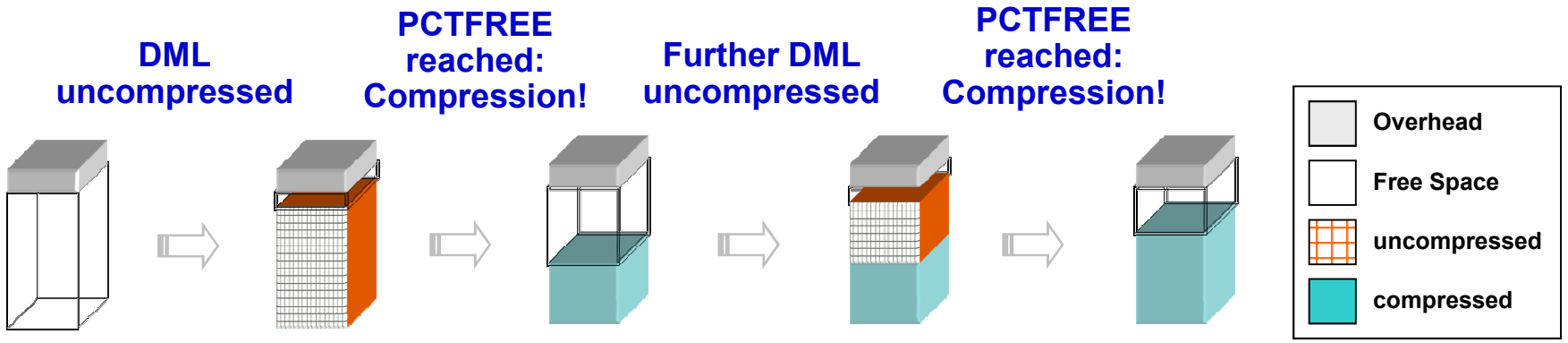
Advanced Compression



- Advanced Compression in Oracle 11*g* works for:
  - Structured and unstructured data
  - Backups
  - Data Pump exports
  - Data Guard gap resolution (11.1.0.7 => LGWR ASYNC)
- Reduces resource requirements and costs!!!
  - Storage
- Typically 2x to 4x compression possible



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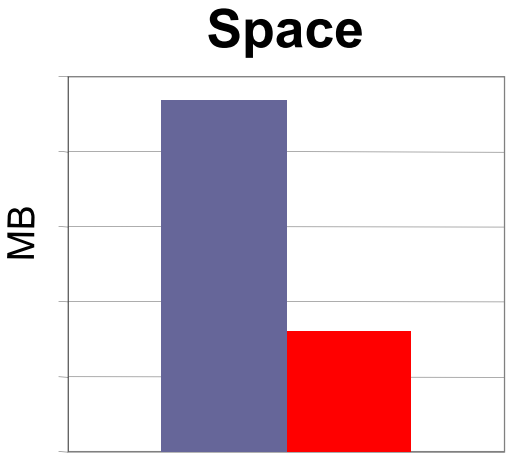
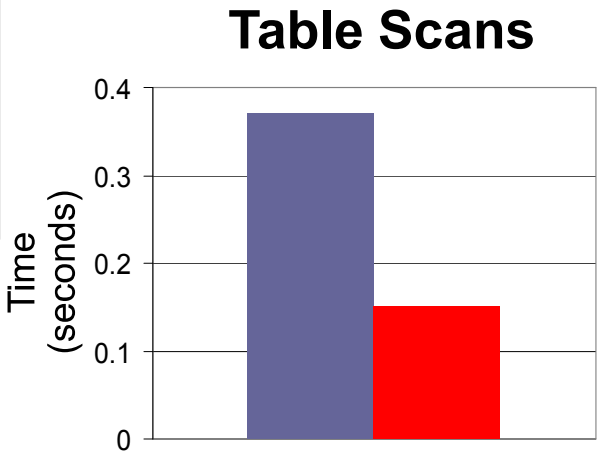
‘Real World’ Compression

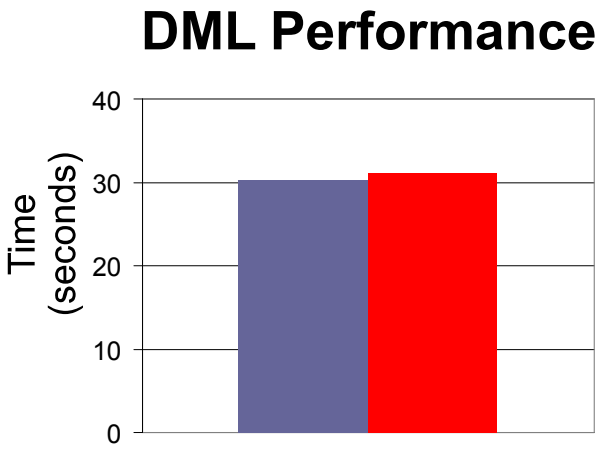
10 largest ERP database tables



3x Savings



2.5x faster



< 3% overhead

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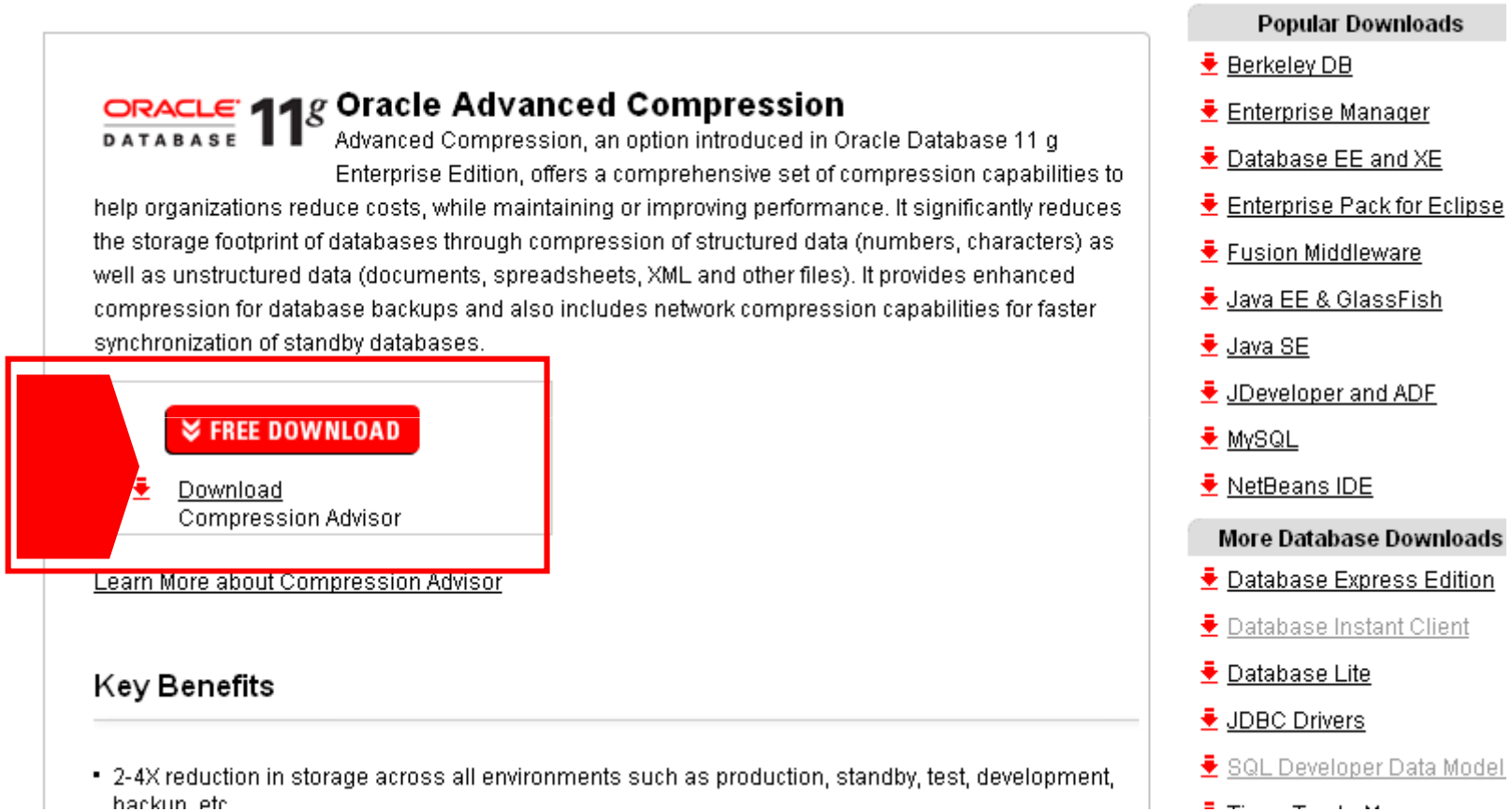
Compression Advisor - Free Download

- http://www.oracle.com/technetwork/database/options/compression/index.html



- Since 11.2: `DBMS_COMPRESSION` package

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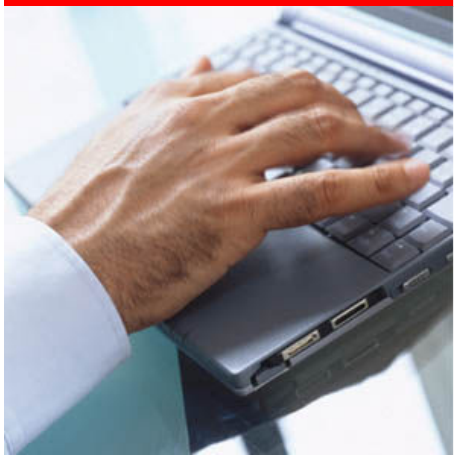
Agenda



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- Best Practices

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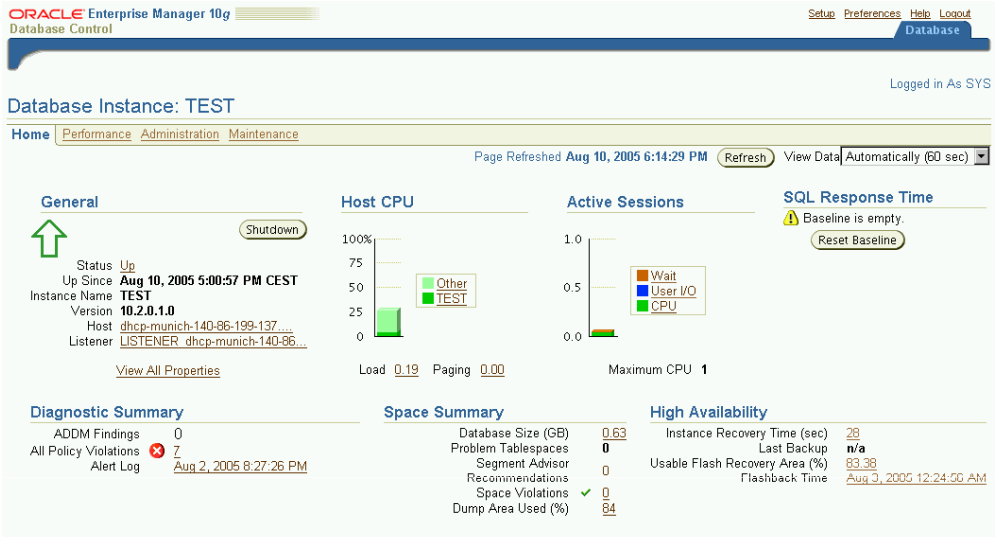
Tuning with the right tools ...




```
SQL> set autotrace traceonly explain

SQL> select *
  2  from emp, dept
  3  where emp.deptno = dept.deptno
  4  and emp.job = 'CLERK';

Execution Plan
----------------------------------------------------------
Plan hash value: 877088642

--------------------------------------------------------------------------------
| Id |   Operation                  | Name  | Rows  | Bytes          | Cost ($CPU)
--------------------------------------------------------------------------------
|  0 |  SELECT STATEMENT            |       |     4 |   468          |     7      (15)
|* 1 |  HASH JOIN                   |       |     4 |   468          |     7      (15)
|* 2 |  TABLE ACCESS FULL           | EMP   |     4 |   348          |     3       (0)
|  3 |  TABLE ACCESS FULL           | DEPT  |     4 |   120          |     3       (0)
--------------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------
   1 - access("EMP"."DEPTNO"="DEPT"."DEPTNO")
   2 - filter("EMP"."JOB"='CLERK')
Note
-----
   - dynamic sampling used for this statement
```

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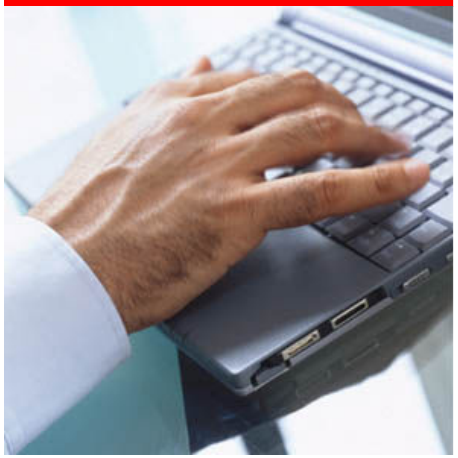
Agenda



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Optimizer Statistics Gathering

- DML Monitoring is switched ON for all tables
- INSERTS, UPDATES and DELETES will be monitored
- To exclude tables lock their statistics
  - ```
    SQL> exec DBMS_STATS.LOCK_TABLE_STATS('SH','TAB1');
    ```
- For statistics collection always use DBMS_STATS, never use ANALYZE anymore

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    ```
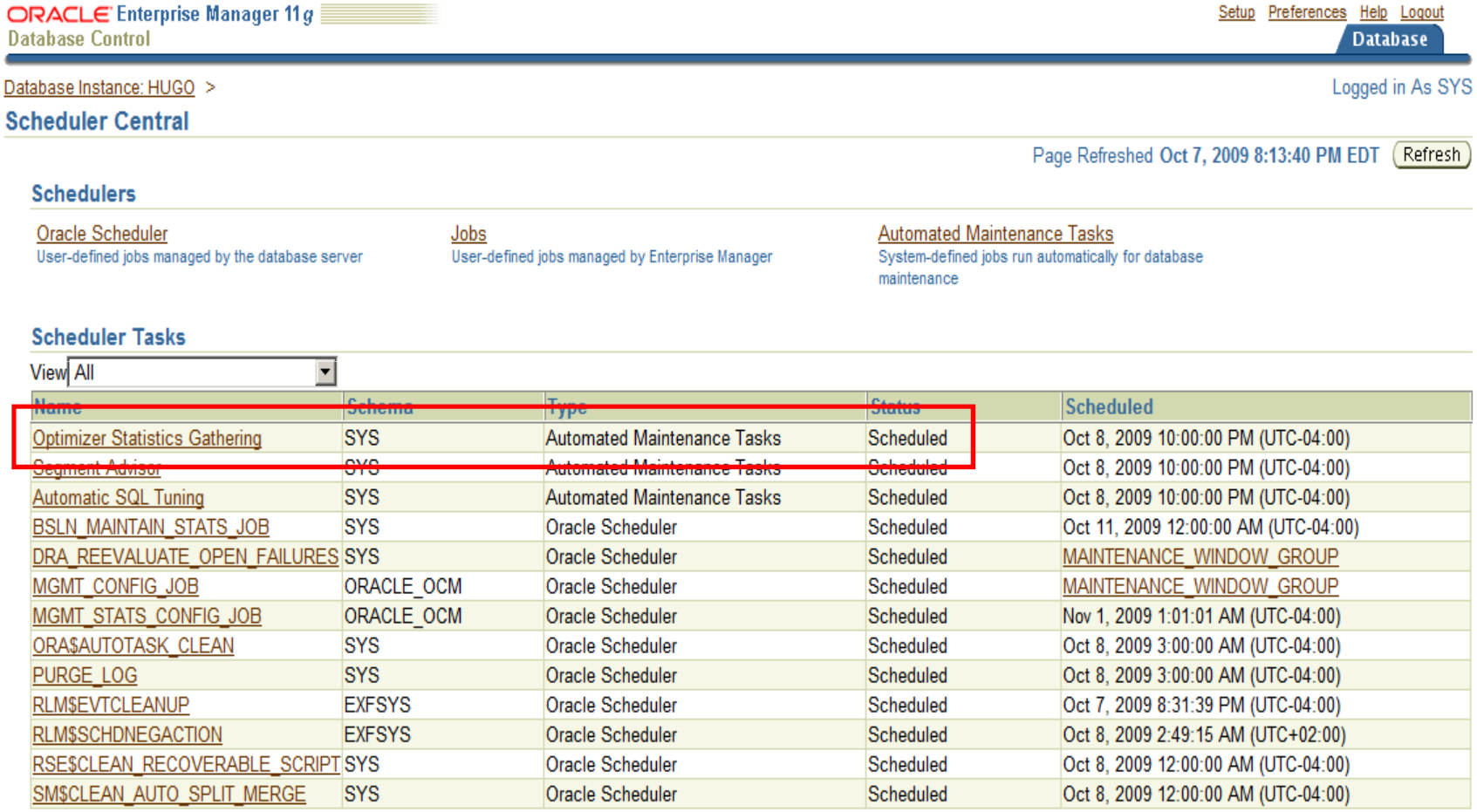

Optimizer Statistics Gathering

- Default maintenance job



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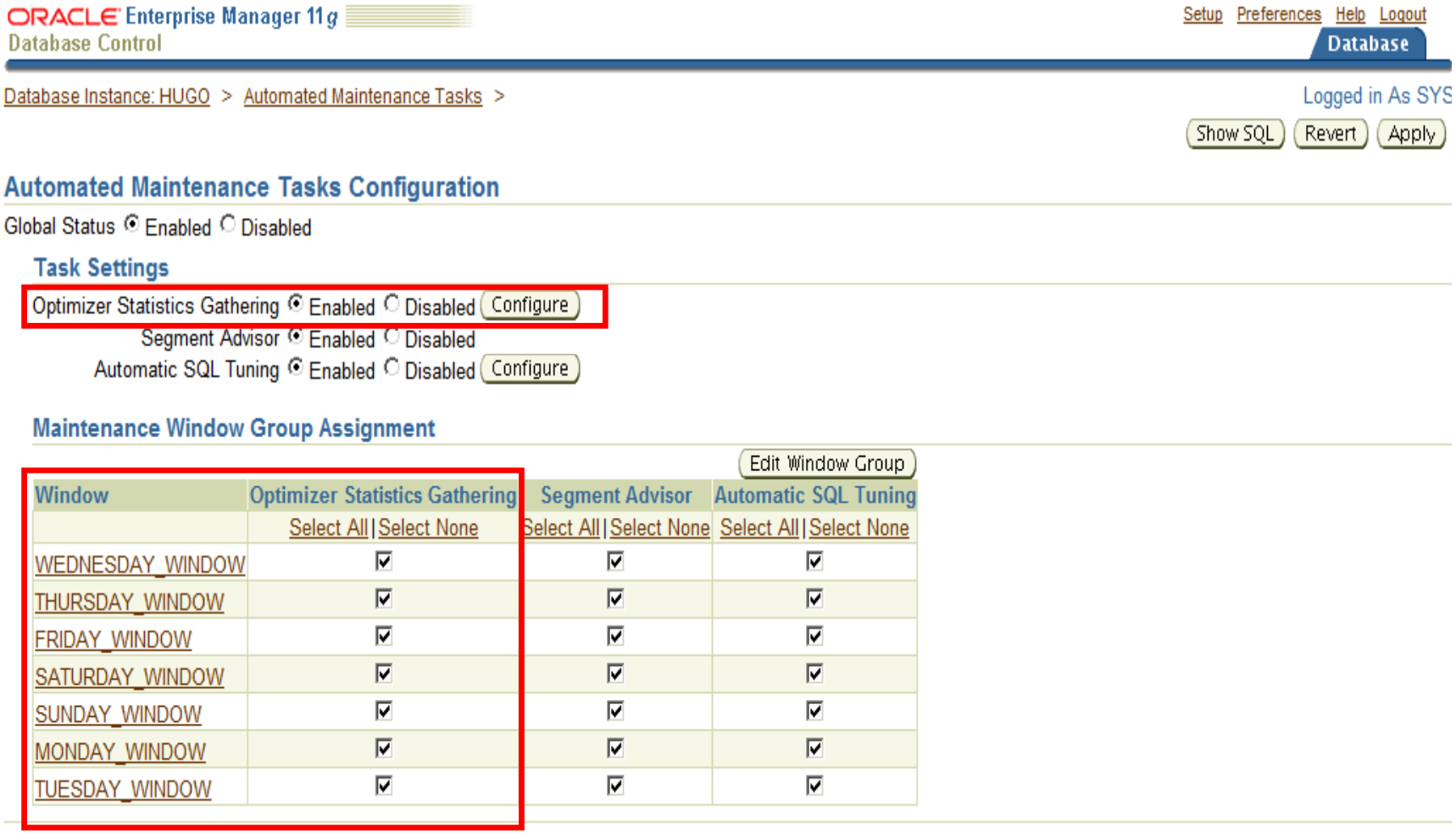
Optimizer Statistics Gathering

- Configure maintenance schedule



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Optimizer Statistics Gathering

- Configure settings and parameters

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GATHER_STATS_JOB in 11*g*

- Starting the job manually:
  - Start:

```
SQL> exec DBMS_AUTO_TASK_IMMEDIATE.GATHER_OPTIMIZER_STATS
```

  - Monitoring progress:

```
SELECT job_name,state
FROM dba_scheduler_jobs
WHERE program_name='GATHER_STATS_PROG';
```

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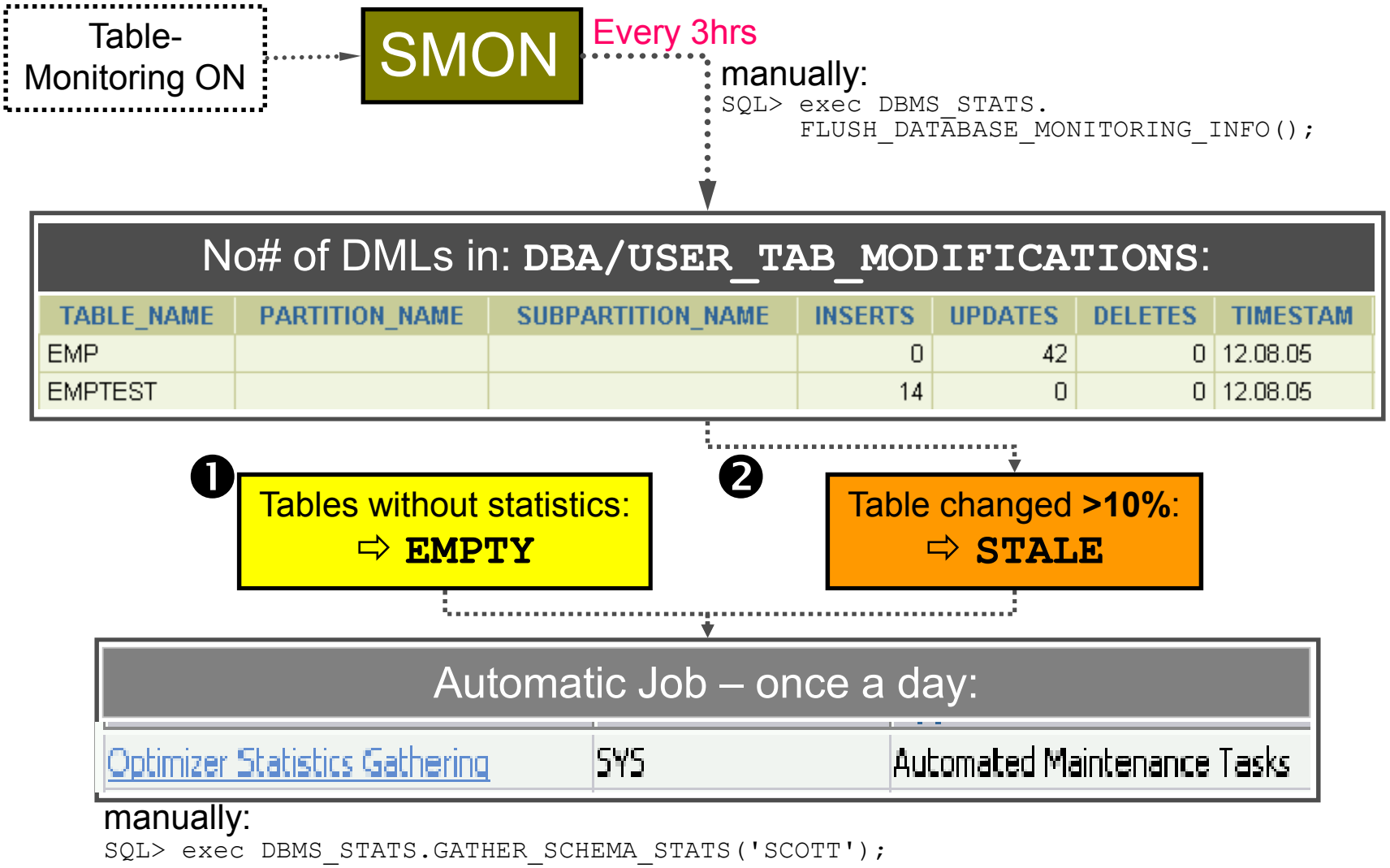
GATHER_STATS_JOB



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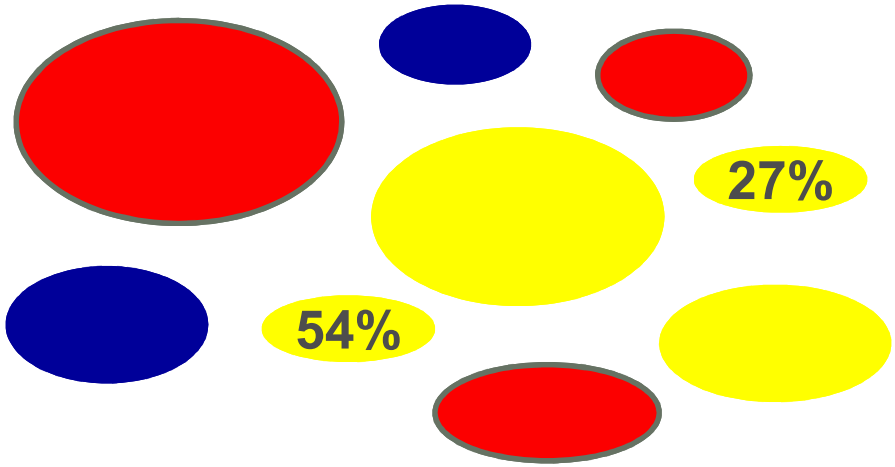
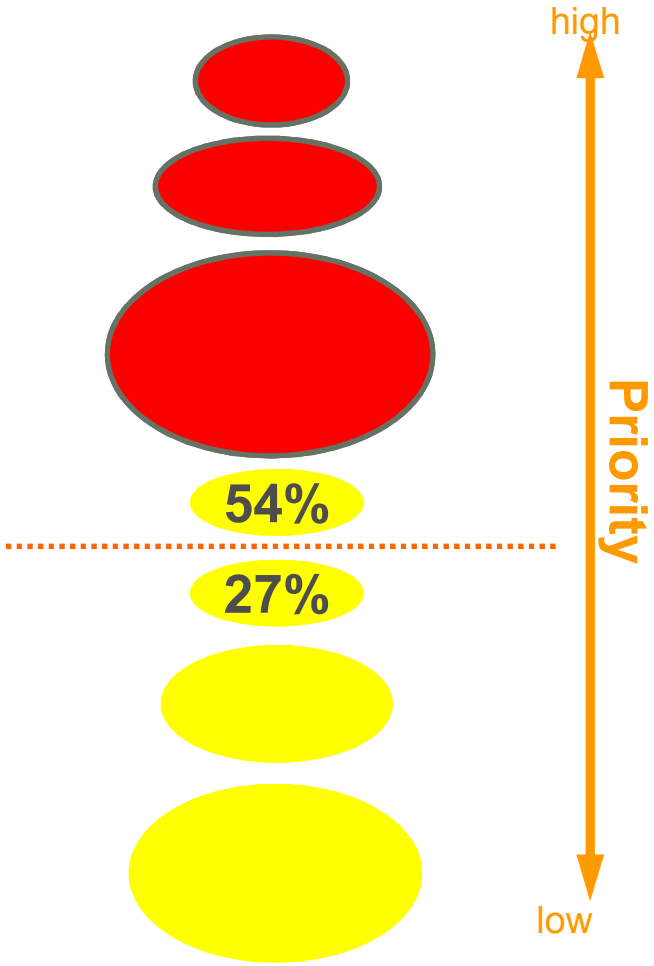
GATHER_STATS_JOB

Objects:



Analysis order:



Statistics: EMPTY

Statistics: STALE

Statistics: OK

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Optimizer without statistics

- What happens if there are no object statistics?
  - The optimizer (CBO) will estimate (at parsing time) the statistics for tables and indexes
  - Prerequisite:
    `OPTIMIZER_DYNAMIC_SAMPLING=2` [Default since 10*g*]
    - Level 0 - Dynamic Sampling off (~OLTP)
    - Level 2 – Optimizer checks first 64 blocks of object
      - For descriptions of all levels:
        Performance Tuning Guide

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Adaptive Cursor Sharing

- Adaptive cursor sharing introduced in 11*g*
- Common problem:
  - When bind variables are used, the initial plan can be suboptimal due to the fact that
    - Future values used in future executions share the initial plan
    - The first set of binds used may not be representative of the majority of executions
  - For an example and more explanation see Note:836256.1

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Extended Optimizer Statistics

- Business problem - Correlated Columns
  - Real data often shows correlations between various attributes
    - E.g. job title influences salary, car model influences make, seasons affect the amount of sold goods (e.g. snow shoes in winter)
  - Optimizer has to estimate the correct cardinality
    - *"Does an additional filter reduce the result set or not?"*
- Solution
  - Extended Optimizer Statistics provides a mechanism to collect statistics on a group of columns
  - Full integration into existing statistics framework
    - Automatically maintained with column statistics
    - Instantaneous and transparent benefit for any migrated application

Improved Cardinality leads to Improved Plans

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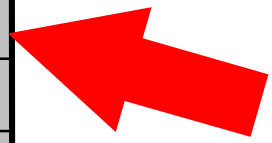
Example

Single column

```
SELECT ……FROM..
WHERE model = '530xi'
```

BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER



Make	Model	Color
BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER
PORSCHE	911	RED
MERC	SLK	BLACK
MERC	C320	SLIVER

- Three records selected.
  - Single column statistics are accurate

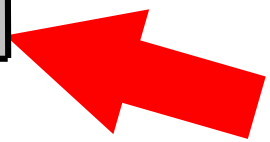
```
-------------------------------------------------------------------------
| Id  | Operation          | Name        | Starts | E-Rows | A-Rows |
-------------------------------------------------------------------------
|*  1 |    TABLE ACCESS FULL| CARS        |      1 |      3 |      3 |
-------------------------------------------------------------------------
```

Example

Non-correlated columns

```
SELECT ……FROM..
WHERE model = '530xi'
AND color = 'RED'
```

BMW	530xi	RED



Make	Model	Color
BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER
PORSCHE	911	RED
MERC	SLK	BLACK
MERC	C320	SLIVER

- One record selected
  - No correlated columns
  - Additional predicate reduces result set
  - Single column statistics are sufficient

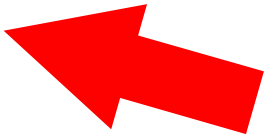
```
-------------------------------------------------------------------
| Id  | Operation           | Name       | Starts | E-Rows | A-Rows |
-------------------------------------------------------------------
|*  1 |    INDEX RANGE SCAN| C_MC        |      1 |      1 |      1 |
-------------------------------------------------------------------
```

Example

Correlated columns - no extended statistics

```
SELECT ……FROM..
WHERE model = '530xi'
AND make = 'BMW';
```

BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER



Make	Model	Color
BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER
PORSCHE	911	RED
MERC	SLK	BLACK
MERC	C320	SLIVER

- Three records selected.
  - Correlated columns
  - Additional predicate has no effect
  - Single column statistics are **NOT** sufficient

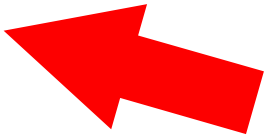
```
-------------------------------------------------------------------------
| Id  | Operation            | Name        | Starts | E-Rows | A-Rows |
-------------------------------------------------------------------------
|*  1 |    INDEX RANGE SCAN| C_MC          |      1 |      1 |      3 |
-------------------------------------------------------------------------
```

Example

Correlated columns - extended statistics

```
SELECT ……FROM..
WHERE model = '530xi'
AND make = 'BMW';
```

BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER

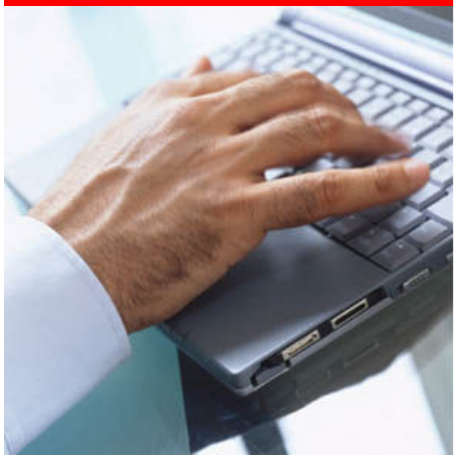


Make	Model	Color
BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER
PORSCHE	911	RED
MERC	SLK	BLACK
MERC	C320	SLIVER

- Three records selected.
  - Multi-column statistics **solve the problem**

```
-------------------------------------------------------------------------
| Id  | Operation           | Name        | Starts | E-Rows | A-Rows |
-------------------------------------------------------------------------
|*  1 |    TABLE ACCESS FULL| CARS        |      1 |      3 |      3 |
-------------------------------------------------------------------------
```

Agenda



- Preparation
- Installation
- Upgrade
- News and Task List
- Diagnostics & Tuning
  - Object Statistics
  - Monitoring
  - SQL Tuning
- Performance Testing
- Best Practices

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Requirements for Diagnostics & Tuning

- `STATISTICS_LEVEL=TYPICAL` [default]
  - Alternative Settings:
    - `BASIC`
    - `ALL`
  - `TYPICAL` (recommended setting) will enable:
    - Automatic SGA Tuning
    - Automatic Statistics Collection
    - Active Session History
    - DML Monitoring

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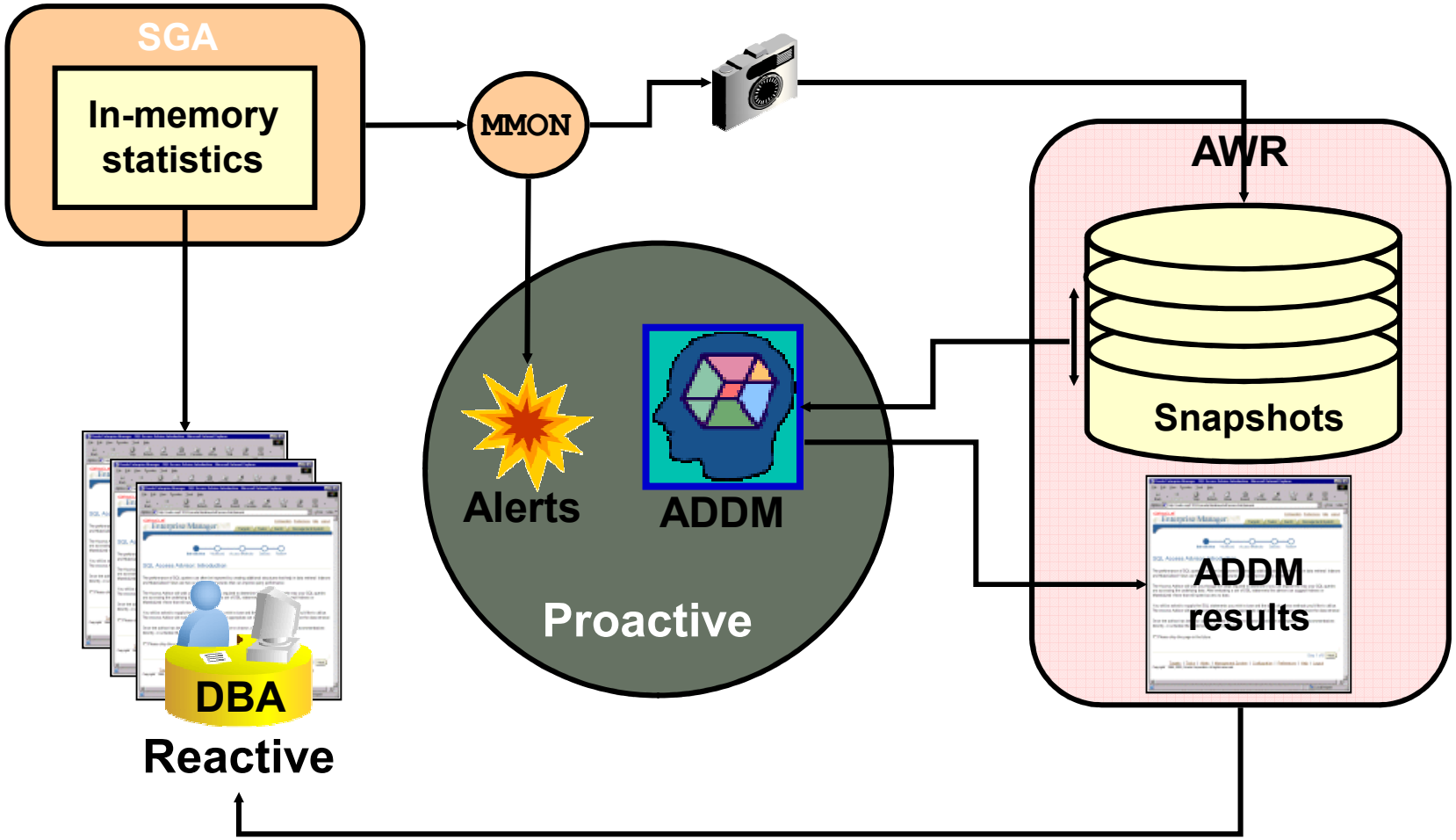
Diagnostics & Tuning Concept since 10*g*



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Tuning Basics since 10*g*

- AWR (Automatic Workload Repository)
  - Statistics repository in SYSAUX tablespace for AWR snapshots
  - Self managing
  - Data stored in the AWR is collected by MMON
    - Every 60 minutes and kept for 8 days `[default]`
    - Query AWR contents: `DBA_HIST-`Views
  - The automatic removal of certain snapshots can be supressed for later analysis by defining them as a baseline
  - Snapshots can be created on demand at every time:
    - `EXEC dbms_workload_repository.create_snapshot();`

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Tuning Basics since 10*g*

- AWR – Most important reports and scripts:
  - AWR size, trend, analysis and SYSAUX usage:
    - `SQL> @?/rdbms/admin/awrinfo.sql`

```
(2) Size estimates for AWR snapshots
************************************
| Estimates based on 60 mins snapshot INTERVAL:
|    AWR size/day                          35.0 MB (1,492 K/snap * 24 snaps/day)
|    AWR size/wk                          244.8 MB (size_per_day * 7) per instance
```

  - AWR Reports:
    - SI: `SQL> @?/rdbms/admin/awrrpt.sql`
    - RAC: `SQL> @?/rdbms/admin/awrrpti.sql`
    - Evaluate single statements using the SQLID:
      `SQL> @?/rdbms/admin/awr**sq**rpt.sql`
    - Global AWR Diff report: `SQL> @?/rdbms/admin/awrgrrpt.sql`
  - AWR Extract and Load:
    - Extract: `SQL> @?/rdbms/admin/awrextr.sql`
      (will generate a Data Pump dump file)
    - Load: `SQL> @?/rdbms/admin/awrload.sql`

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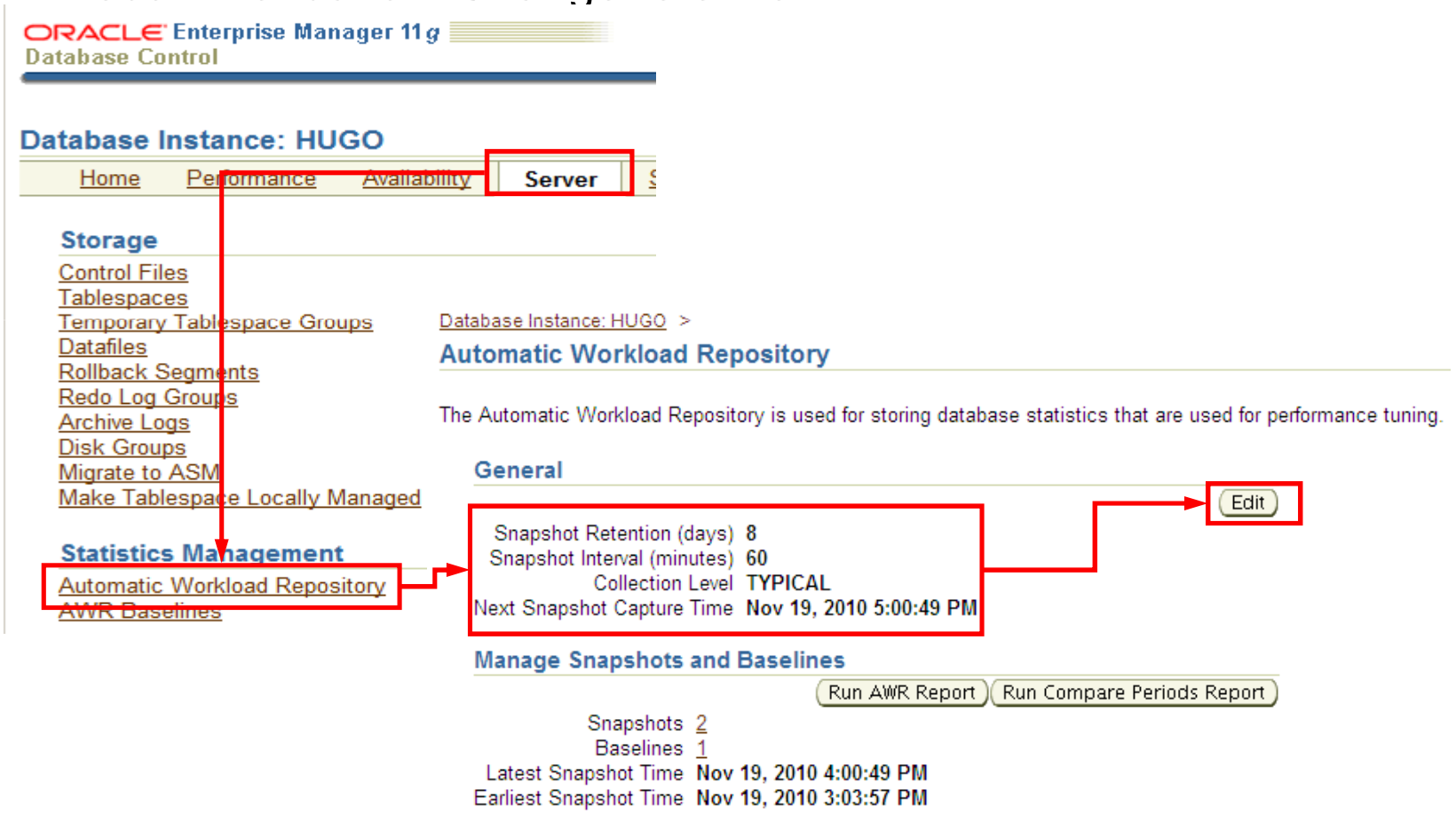
Tuning Basics since 10*g*

- AWR
  - Recommendation: Change retention:



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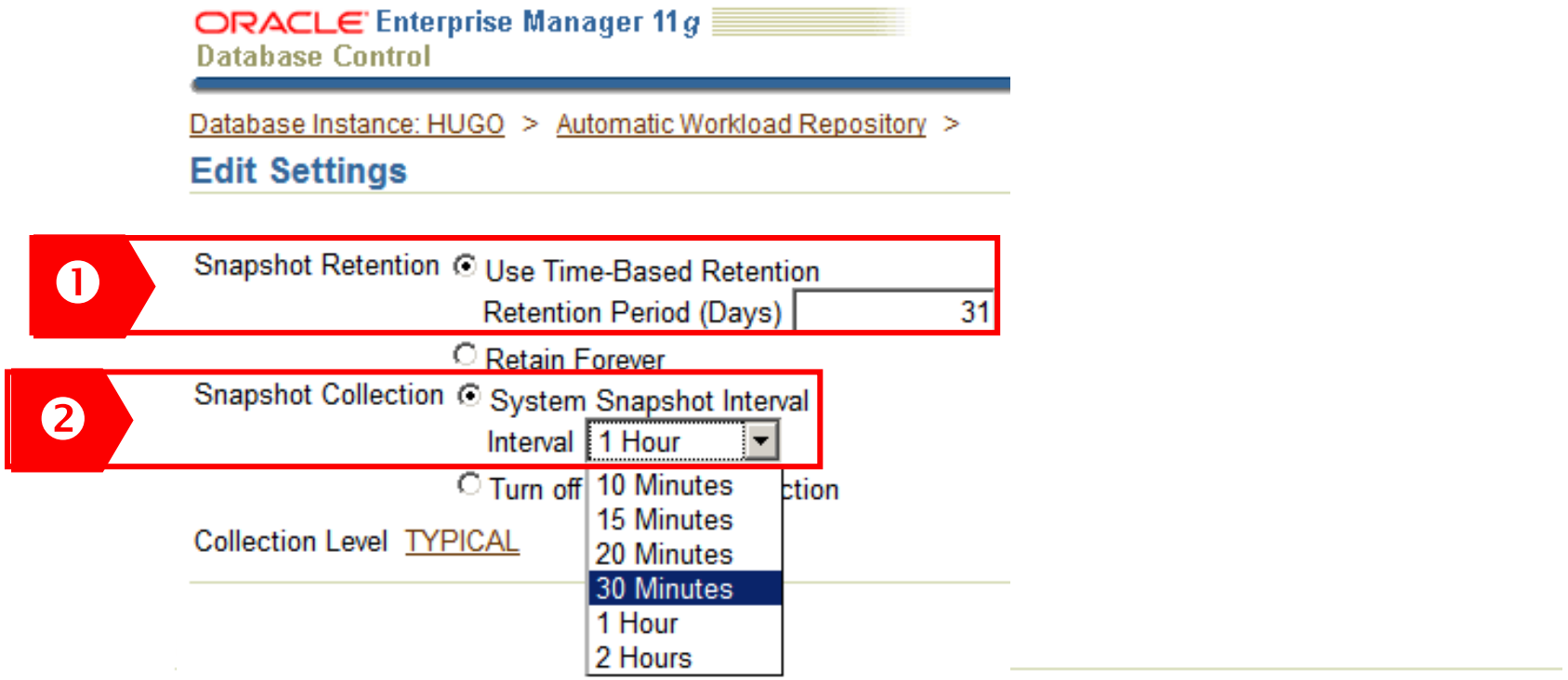
Tuning Basics since 10*g*

- AWR
  - Typical production database values
    - Interval: 30-60 minutes ... retention: 20-31 days




```
begin DBMS_WORKLOAD_REPOSITORY.MODIFY_SNAPSHOT_SETTINGS(44640,60); end;
```

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Tuning Basics since 10*g*

- ASH (Active Session History)
  - ASH is key for database diagnosis
  - Circular buffer inside the SGA
  - Fixed size: 2MB x #CPUs (max. 5% of the SGA or <30MB)
  - Contains information about active sessions
  - ~10% of the information gets written to the AWR by MMNL
  - View: V$ACTIVE_SESSION_HISTORY
  - Further info: Note:243132.1
  - Report:
    - SI: `SQL> @?/rdbms/admin/ashrpt.sql`
    - RAC: `SQL> @?/rdbms/admin/ashrpti.sql`

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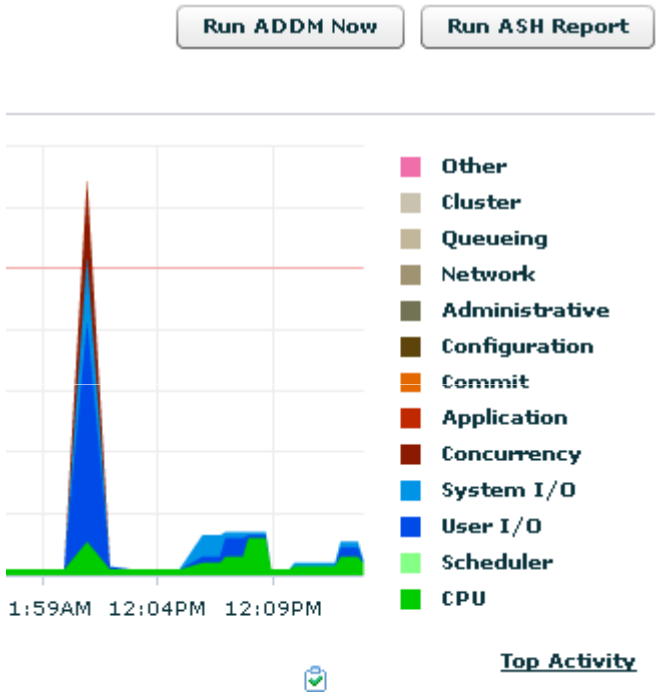
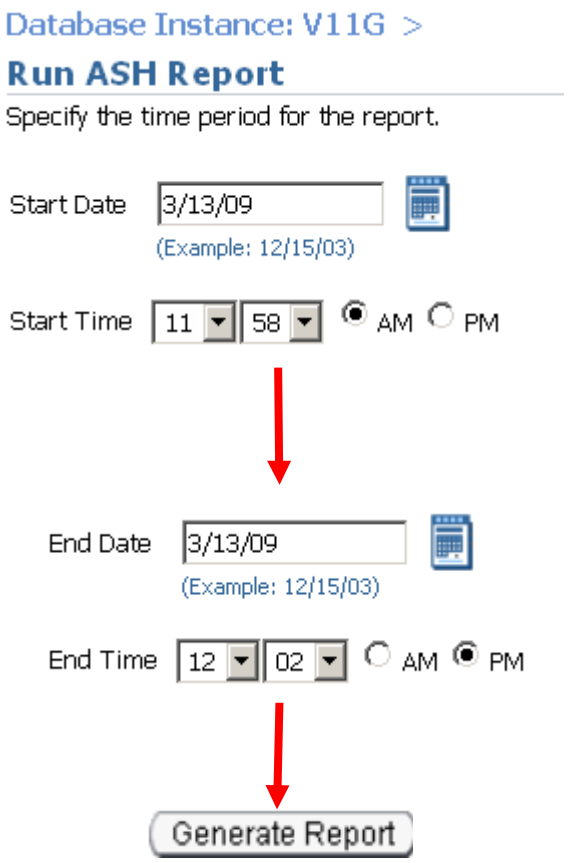
Tuning Basics since 10*g*

- Define ASH reporting interval





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Tuning Basics since 10*g*

- ## ASH Report For V11G/v11g

DB Name	DB Id	Instance	Inst num	Release	RAC	Host
V11G	2840163171	v11g	1	11.1.0.7.0	NO	VMTKEXP1

CPUs	SGA Size	Buffer Cache	Shared Pool	ASH Buffer Size
1	511M (100%)	156M (30.5%)	168M (32.9%)	2.0M (0.4%)

	Sample Time	Data Source
Analysis Begin Time:	13-Mar-09 11:58:13	V$ACTIVE_SESSION_HISTORY
Analysis End Time:	13-Mar-09 12:02:13	V$ACTIVE_SESSION_HISTORY
Elapsed Time:	4.0 (mins)	
Sample Count:	91	
Average Active Sessions:	0.38	
Avg. Active Session per CPU:	0.38	
Report Target:	None specified	

ASH Report

- Top Events
- Load Profile
- Top SQL
- Top PL/SQL
- Top Java
- Top Sessions
- Top Objects/Files/Latches
- Activity Over Time

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Tuning Basics - STATSPACK

- STATSPACK is still available in 10g and 11g
  - Use either AWR/ASH (Diagnostic Pack license required) or STATSPACK
  - See Note:394937.1 STATSPACK Guide

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Tuning Basics since 10*g*

- ADDM (Automatic Database Diagnostic Monitor)
  - Knowledge base for performance diagnostics
  - Analyze performance snapshots and give recommendations
  - Runs proactively every hour (upon AWR snapshot) or can be invoked manually:
    - SI: `SQL> @?/rdbms/admin/addmrpt.sql`
    - RAC: `SQL> @?/rdbms/admin/addmrpti.sql`

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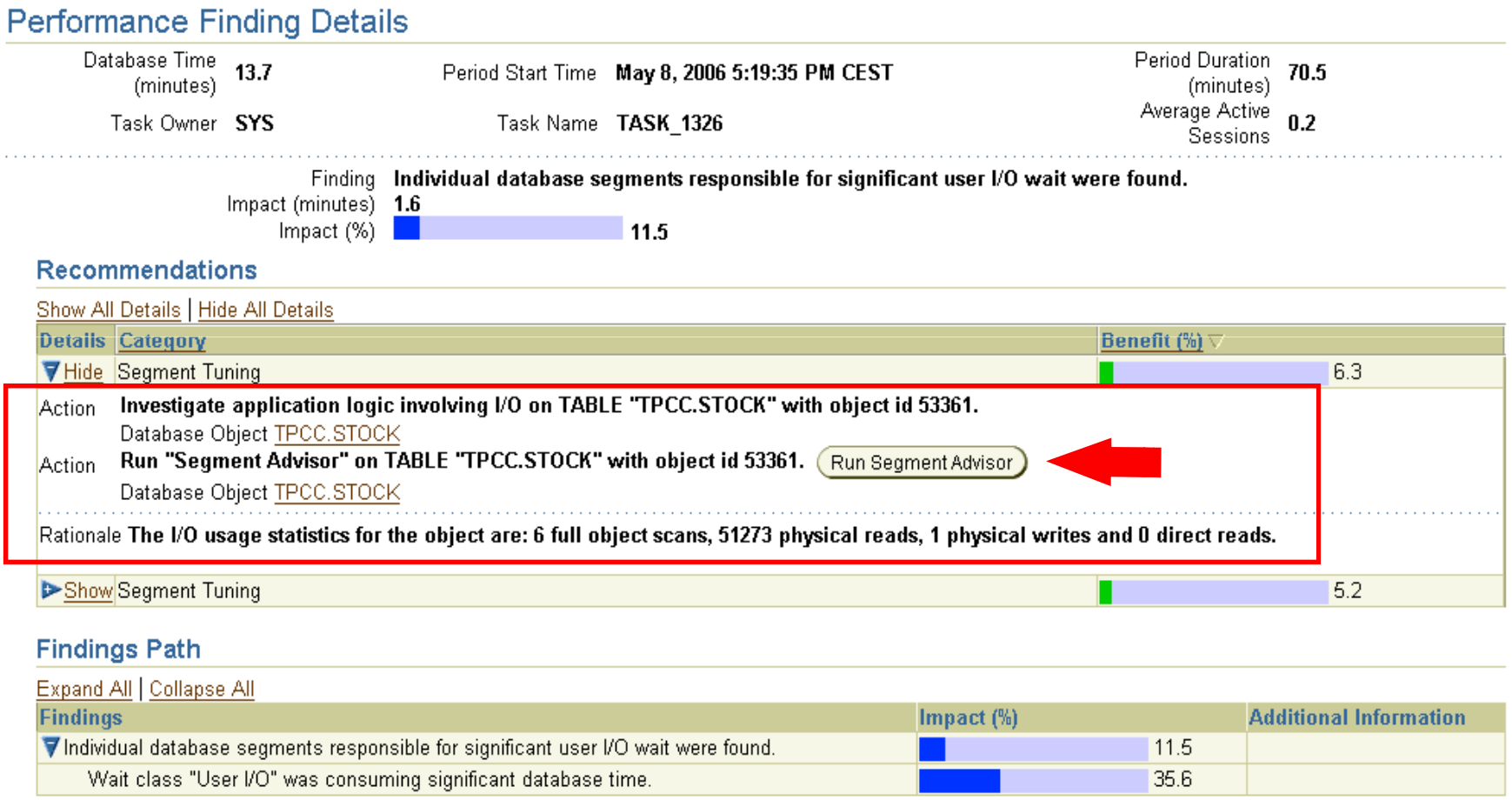
Tuning Basics since 10*g*

- ADDM findings – example:



Performance Finding Details

Database Time (minutes) 13.7 | Period Start Time May 8, 2006 5:19:35 PM CEST | Period Duration (minutes) 70.5
Task Owner SYS | Task Name TASK_1326 | Average Active Sessions 0.2

Finding: Individual database segments responsible for significant user I/O wait were found.
Impact (minutes): 1.6
Impact (%): 11.5

Recommendations

Show All Details | Hide All Details

Details	Category	Benefit (%)
Hide	Segment Tuning	6.3

Action: Investigate application logic involving I/O on TABLE "TPCC.STOCK" with object id 53361.
Database Object TPCC.STOCK
Action: Run "Segment Advisor" on TABLE "TPCC.STOCK" with object id 53361. Run Segment Advisor
Database Object TPCC.STOCK
Rationale: The I/O usage statistics for the object are: 6 full object scans, 51273 physical reads, 1 physical writes and 0 direct reads.

Show	Segment Tuning	5.2

Findings Path

Expand All | Collapse All

Findings	Impact (%)	Additional Information
Individual database segments responsible for significant user I/O wait were found.	11.5	
Wait class "User I/O" was consuming significant database time.	35.6	

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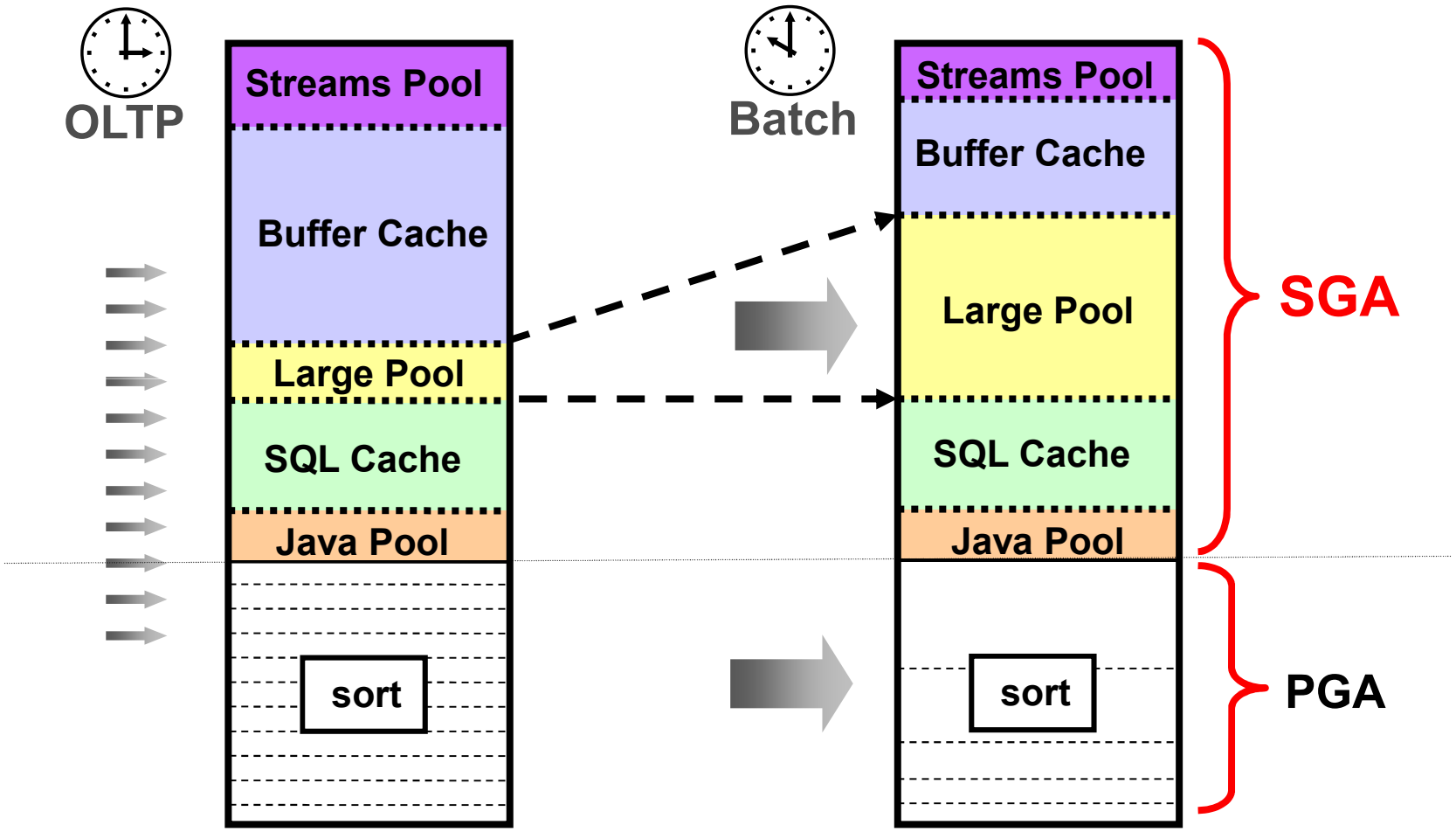
Memory Tuning - SGA & PGA



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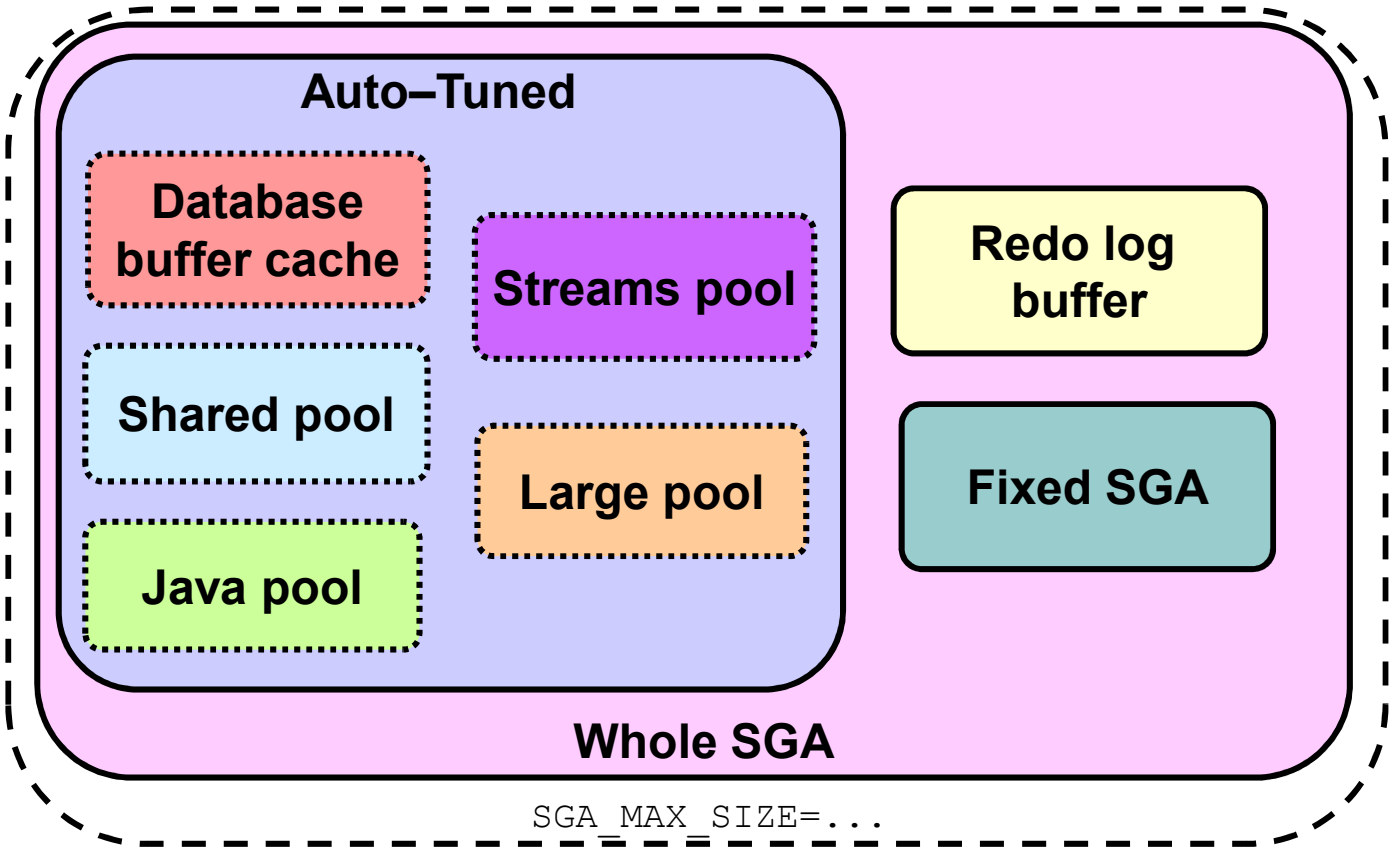
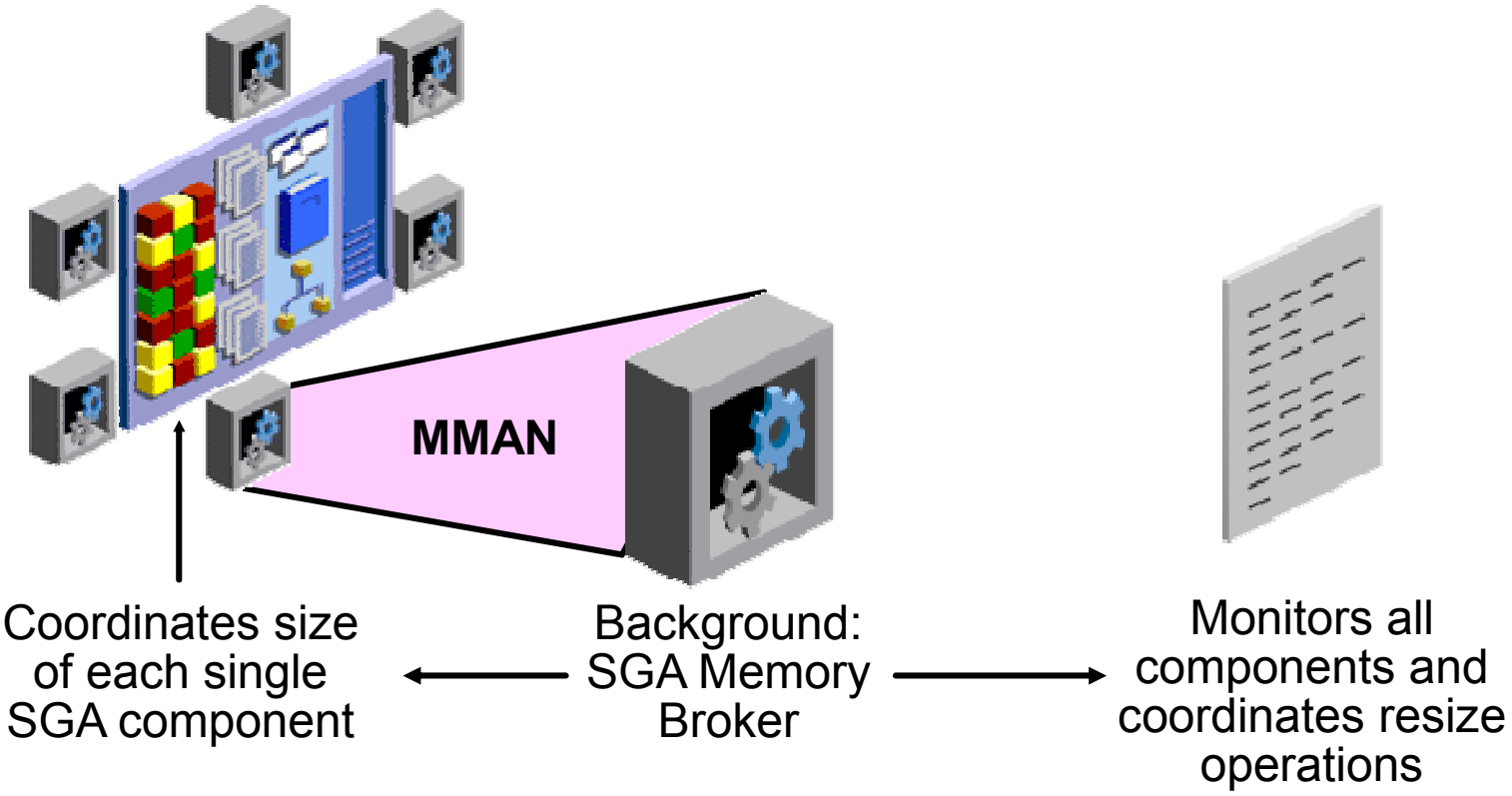
Automatic Shared Memory Management

- To enable ASMM `SGA_TARGET` (or `MEMORY_TARGET`) and `STATISTICS_LEVEL=TYPICAL` must be set

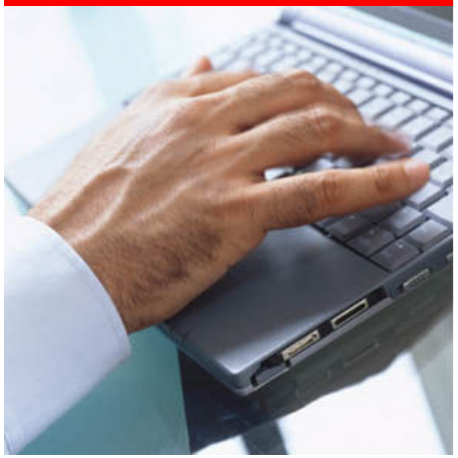


Automatic Shared Memory Management

- Statistics collection driven by MMAN in the background



Agenda



- Preparation
- Installation
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- News and Task List
- Diagnostics & Tuning
  - Object Statistics
  - Monitoring
  - SQL Tuning
- Performance Testing
- Best Practices

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SQL Real-Time Monitoring

- Dedicated statistics collected for a single execution of a SQL statement when its execution becomes high-load
  - Target:
    - Parallel queries, parallel DML or parallel DDL
    - Execution that exceed 5 sec of CPU or I/O time
  - Global SQL level statistics are collected: `V$SQL_MONITOR`
  - Plan level statistics are collected (#rows, memory, temp space, start/end date): `V$SQL_PLAN_MONITOR`
  - Statistics are updated quasi real-time while the query executes
  - Statistics for completed executions are retained for at least 5 minutes
  - Feature switched on by default
    - Note:1229904.1: Real-Time SQL Monitoring in 11g

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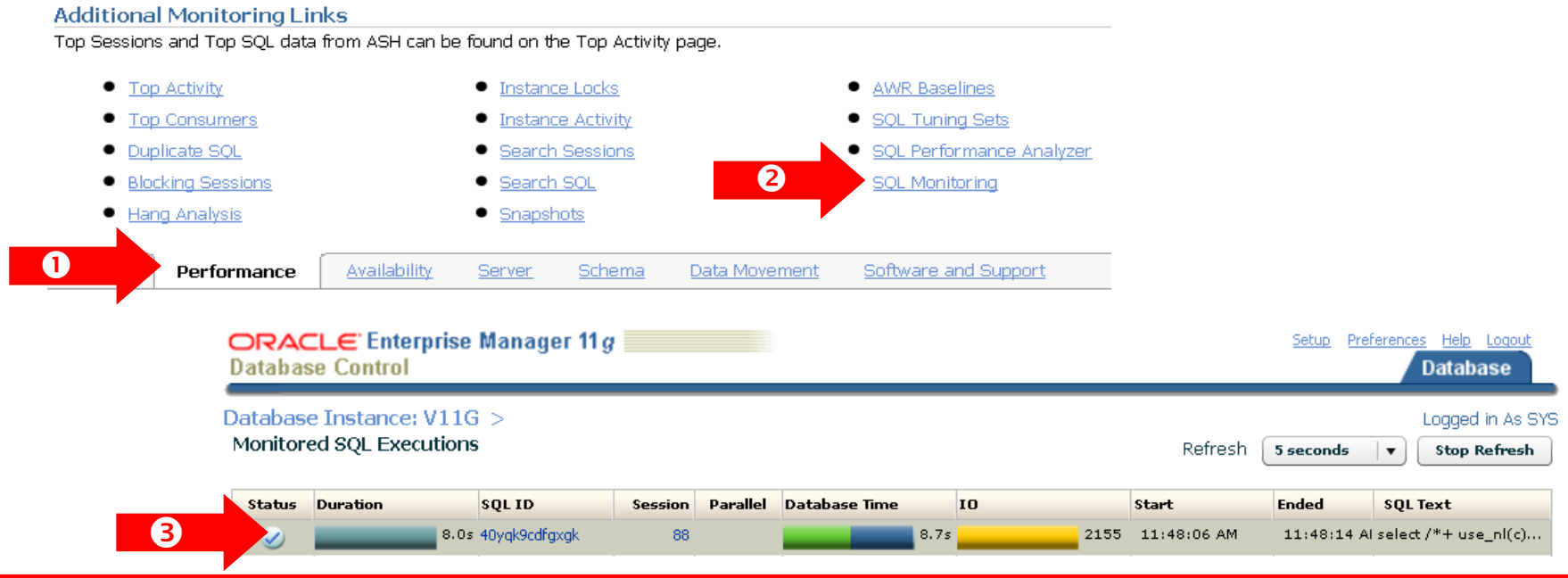
SQL Real-Time Monitoring Report

- **`DBMS_SQLTUNE.REPORT_SQL_MONITOR()`** allows to display monitoring information
  - Format: xml, text and html
  - Join with ASH data
- SQL Real-time monitoring with GUI integrated since 11.1.0.7



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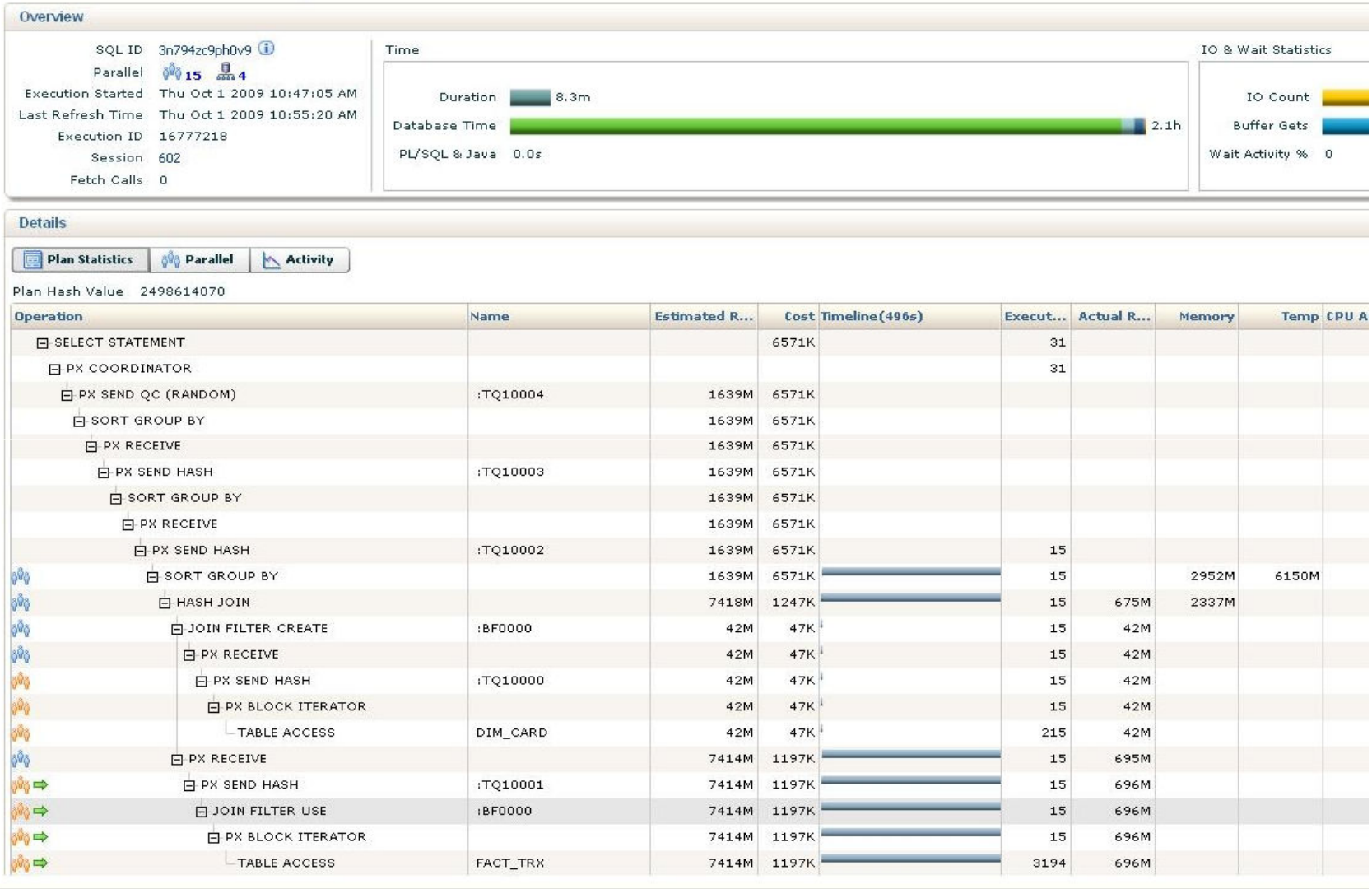
SQL Real-Time Monitoring – Example 1



Overview

SQL ID	3n794zc9ph0v9
Parallel	15 4
Execution Started	Thu Oct 1 2009 10:47:05 AM
Last Refresh Time	Thu Oct 1 2009 10:55:20 AM
Execution ID	16777218
Session	602
Fetch Calls	0

Time

Duration	8.3m
Database Time	2.1h
PL/SQL & Java	0.0s

IO & Wait Statistics

IO Count	
Buffer Gets	
Wait Activity %	0

Details

Plan Statistics | Parallel | Activity

Plan Hash Value 2498614070

Operation	Name	Estimated R...	Cost	Timeline(496s)	Execut...	Actual R...	Memory	Temp	CPU A
SELECT STATEMENT			6571K		31				
PX COORDINATOR					31				
PX SEND QC (RANDOM)	:TQ10004	1639M	6571K						
SORT GROUP BY		1639M	6571K						
PX RECEIVE		1639M	6571K						
PX SEND HASH	:TQ10003	1639M	6571K						
SORT GROUP BY		1639M	6571K						
PX RECEIVE		1639M	6571K						
PX SEND HASH	:TQ10002	1639M	6571K		15				
SORT GROUP BY		1639M	6571K		15		2952M	6150M	
HASH JOIN		7418M	1247K		15	675M	2337M		
JOIN FILTER CREATE	:BF0000	42M	47K		15	42M			
PX RECEIVE		42M	47K		15	42M			
PX SEND HASH	:TQ10000	42M	47K		15	42M			
PX BLOCK ITERATOR		42M	47K		15	42M			
TABLE ACCESS	DIM_CARD	42M	47K		215	42M			
PX RECEIVE		7414M	1197K		15	695M			
PX SEND HASH	:TQ10001	7414M	1197K		15	696M			
JOIN FILTER USE	:BF0000	7414M	1197K		15	696M			
PX BLOCK ITERATOR		7414M	1197K		15	696M			
TABLE ACCESS	FACT_TRX	7414M	1197K		3194	696M			

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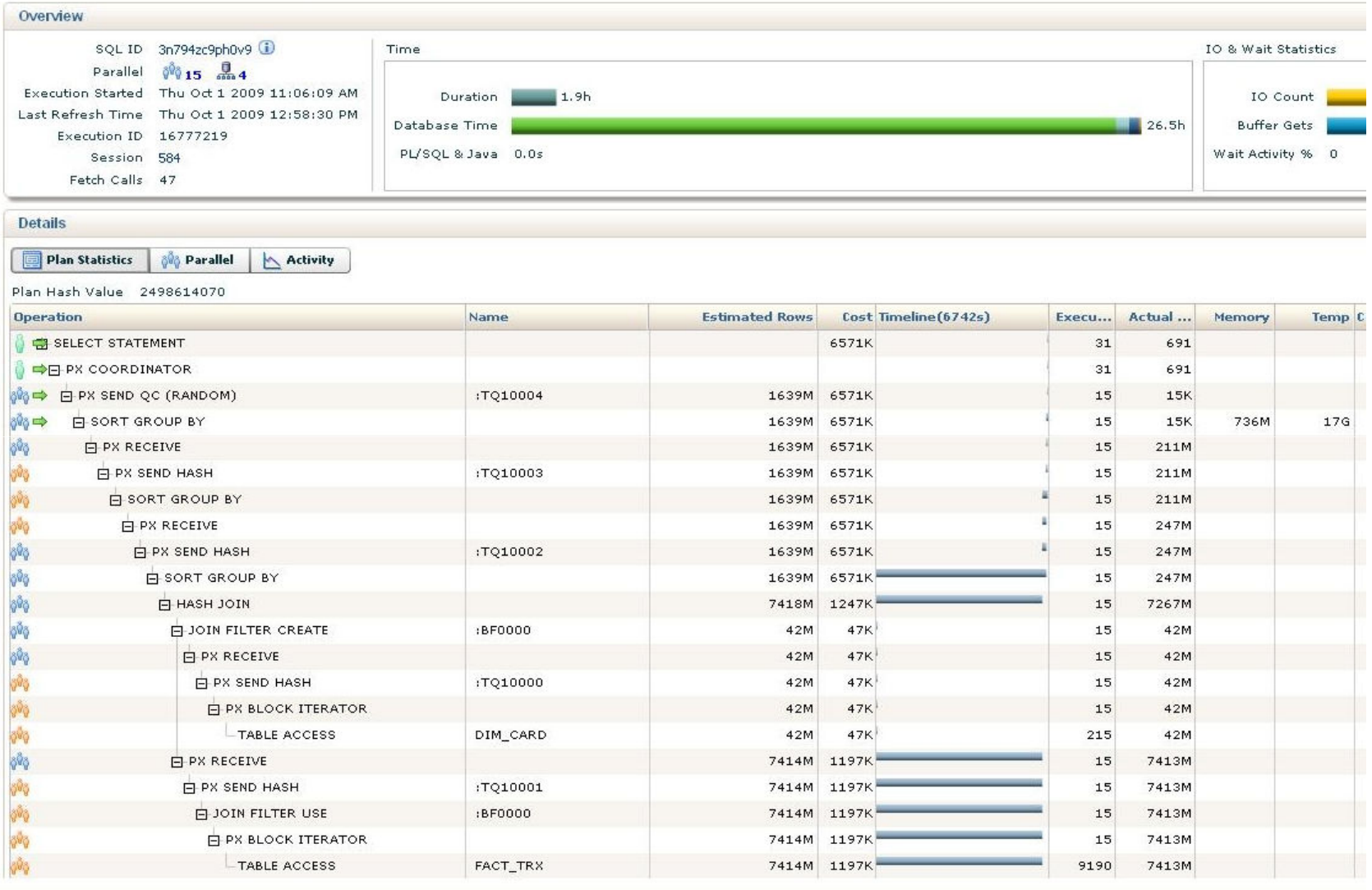
SQL Real-Time Monitoring – Example 2



Overview

SQL ID	3n794zc9ph0v9
Parallel	15 4
Execution Started	Thu Oct 1 2009 11:06:09 AM
Last Refresh Time	Thu Oct 1 2009 12:58:30 PM
Execution ID	16777219
Session	584
Fetch Calls	47

Time

Duration	1.9h
Database Time	26.5h
PL/SQL & Java	0.0s

IO & Wait Statistics

IO Count	
Buffer Gets	
Wait Activity %	0

Details

Plan Statistics | Parallel | Activity

Plan Hash Value 2498614070

Operation	Name	Estimated Rows	Cost	Timeline(6742s)	Execu...	Actual ...	Memory	Temp
SELECT STATEMENT			6571K		31	691		
PX COORDINATOR					31	691		
PX SEND QC (RANDOM)	:TQ10004	1639M	6571K		15	15K		
SORT GROUP BY		1639M	6571K		15	15K	736M	17G
PX RECEIVE		1639M	6571K		15	211M		
PX SEND HASH	:TQ10003	1639M	6571K		15	211M		
SORT GROUP BY		1639M	6571K		15	211M		
PX RECEIVE		1639M	6571K		15	247M		
PX SEND HASH	:TQ10002	1639M	6571K		15	247M		
SORT GROUP BY		1639M	6571K		15	247M		
HASH JOIN		7418M	1247K		15	7267M		
JOIN FILTER CREATE	:BF0000	42M	47K		15	42M		
PX RECEIVE		42M	47K		15	42M		
PX SEND HASH	:TQ10000	42M	47K		15	42M		
PX BLOCK ITERATOR		42M	47K		15	42M		
TABLE ACCESS	DIM_CARD	42M	47K		215	42M		
PX RECEIVE		7414M	1197K		15	7413M		
PX SEND HASH	:TQ10001	7414M	1197K		15	7413M		
JOIN FILTER USE	:BF0000	7414M	1197K		15	7413M		
PX BLOCK ITERATOR		7414M	1197K		15	7413M		
TABLE ACCESS	FACT_TRX	7414M	1197K		9190	7413M		

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Manual SQL Tuning Challenges

- Complex - requires expertise in several domains
  - SQL optimization: adjust the execution plan
  - Access design: provide fast data access
  - SQL design: use appropriate SQL constructs
- Time consuming
  - Each SQL statement is unique
  - Potentially large number of statements to tune
- Never ending task
  - SQL workload always evolving
  - Plan regressions can happen

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SQL Tuning Automation in 11*g*

- Fully automatic SQL Tuning task
  - Runs automatically in the Maintenance Window
  - Identifies, ranks and tunes candidate SQL
  - Leverages SQL Tuning Advisor
- Candidate SQL automatically chosen
  - Excluded: parallel queries, DML/DDL, recursive, ad-hoc (infrequent)
- Tests and (optionally) implements SQL profiles
  - Only implements significantly improved plans (3x)
  - Time budgeted to avoid run-away plans
- DBA can still invoke the advisor manually for reactive tuning, like in 10*g*

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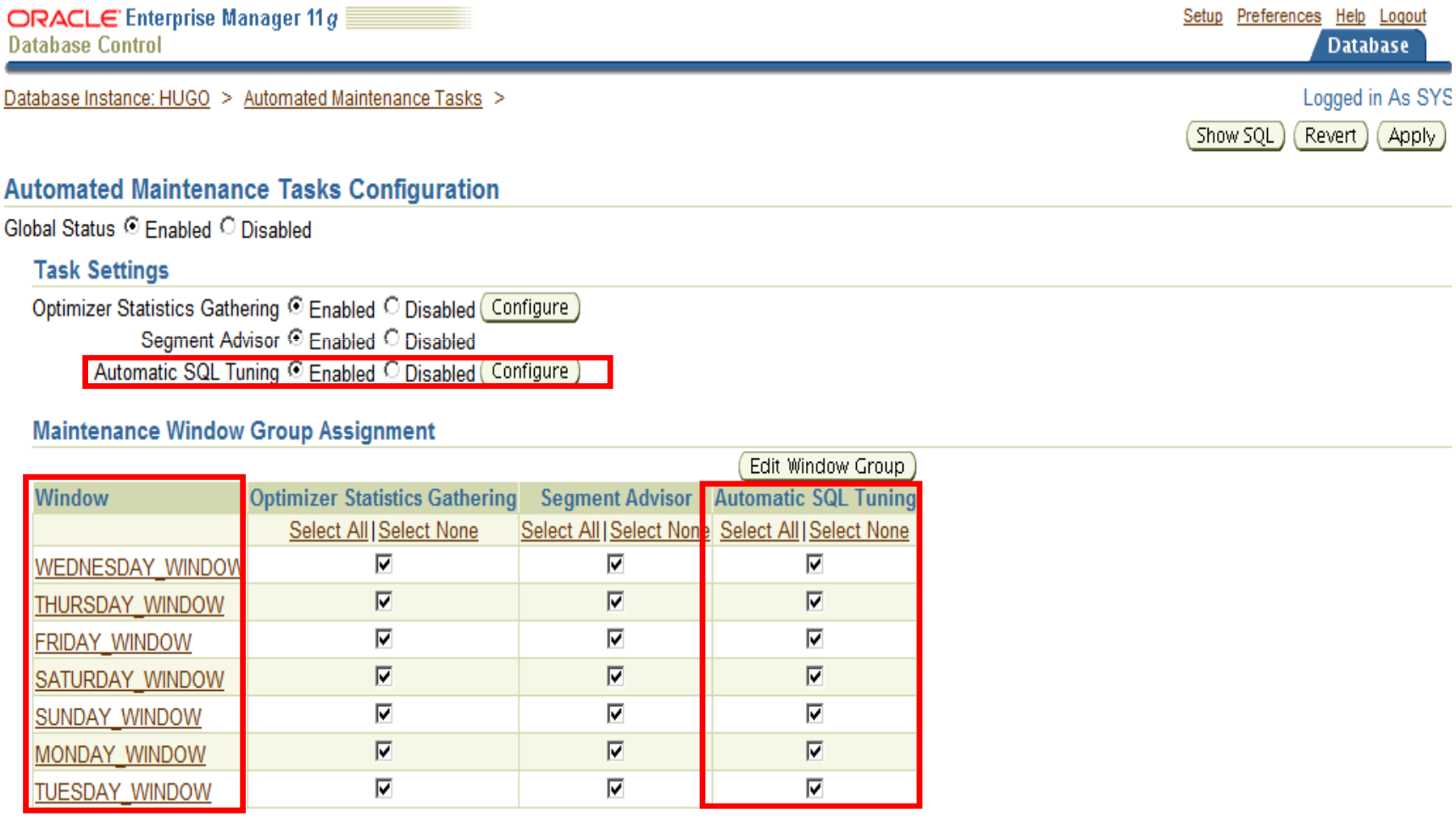
SQL Tuning Automation in 11*g*

- Configure Automatic SQL Tuning



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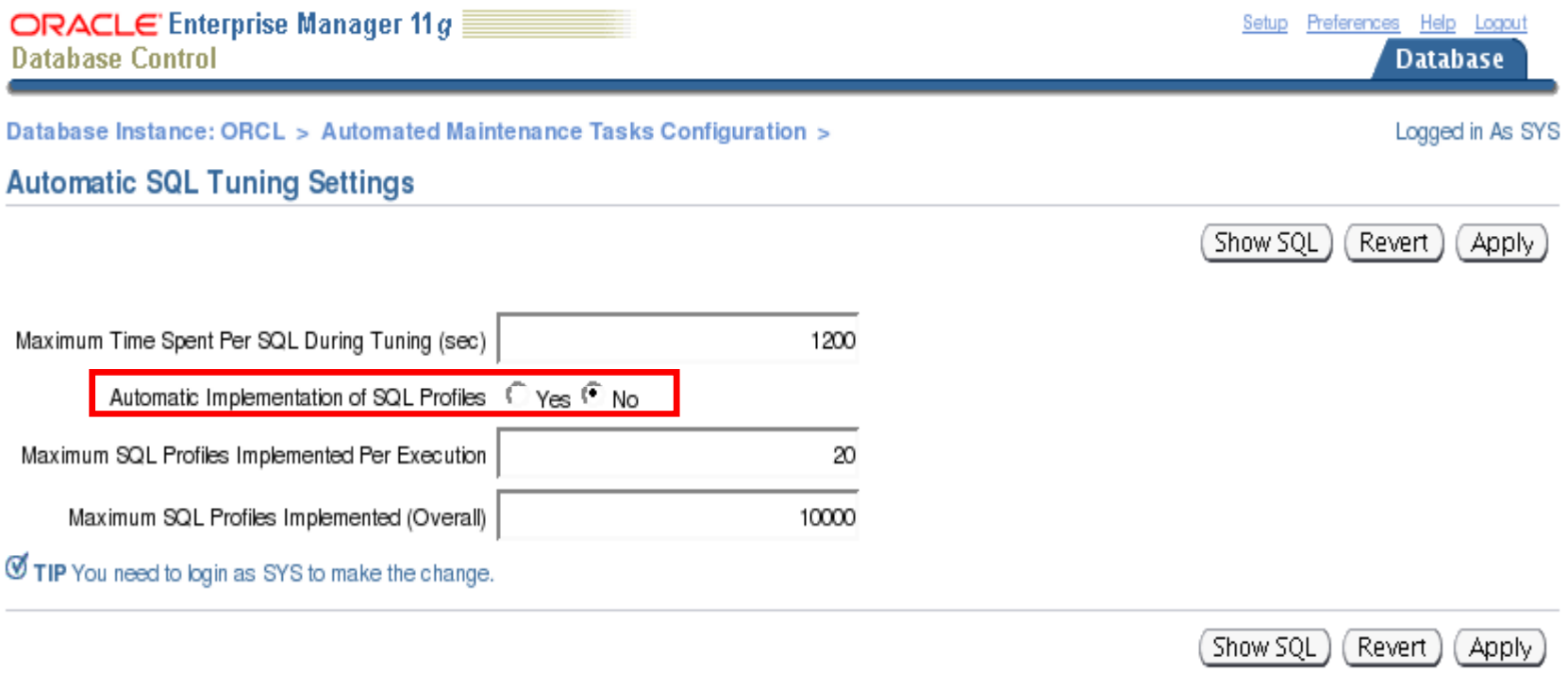
SQL Tuning Automation in 11*g*

- Configure Automatic SQL Tuning



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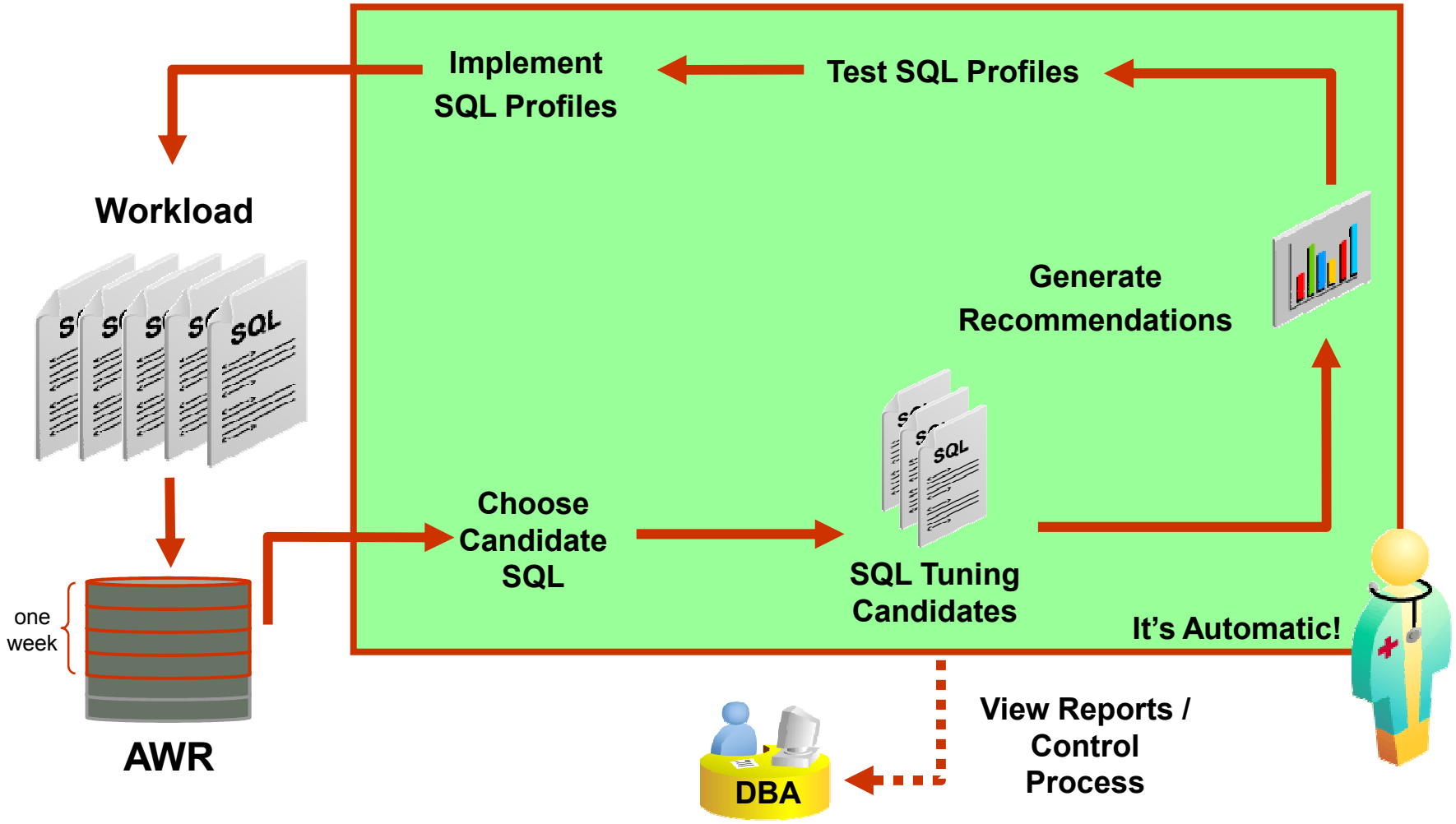
Automatic SQL Tuning in 11*g*



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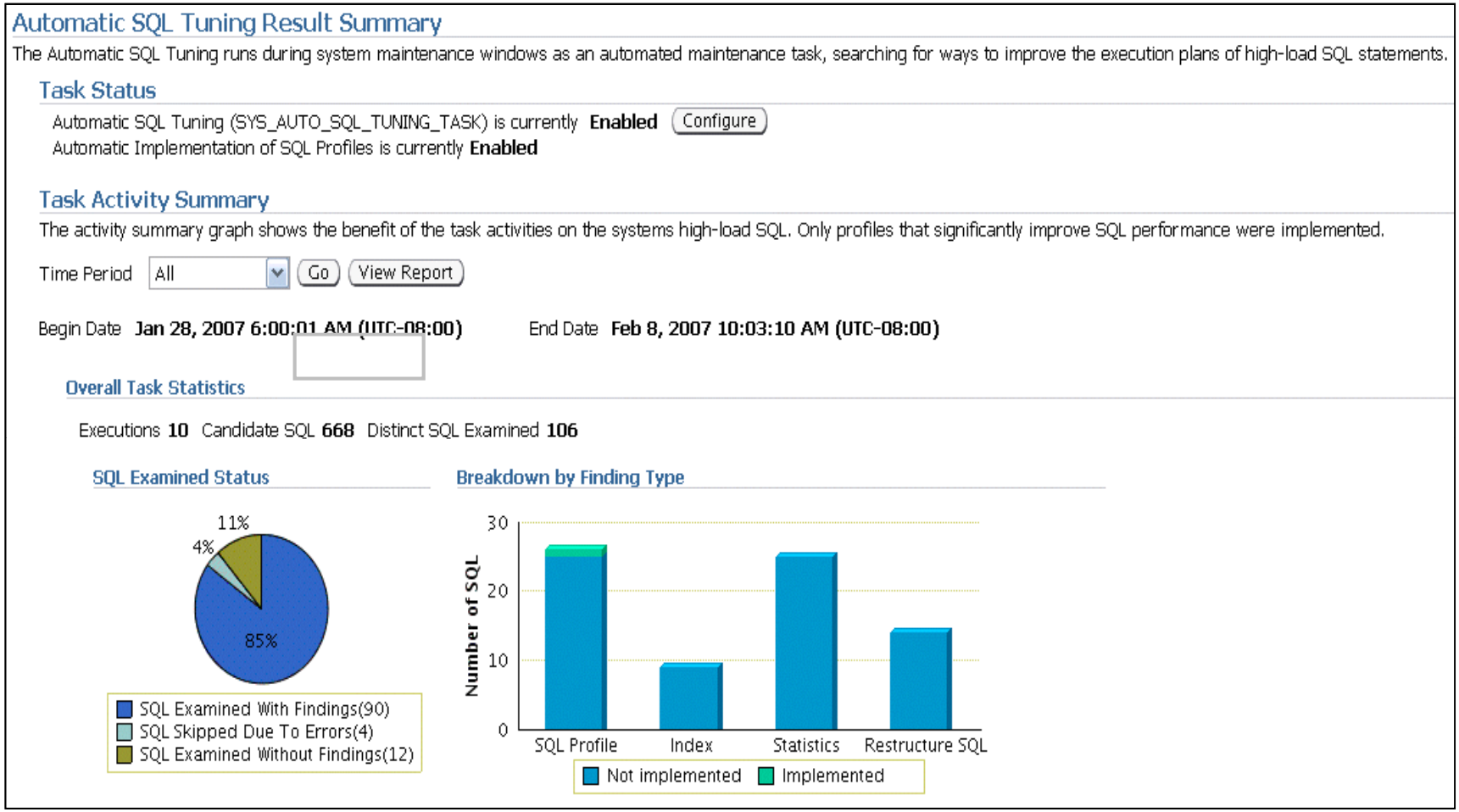
Result Summary



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SQL Tuning - step-by-step

1. Monitoring
2. Identify statement(s) requiring tuning
3. Use tuning advisors
   - SQL Access Advisor:
     - Indexes
     - Materialized Views
     - Indexes on Materialized Views
     - Requires a workload
   - SQL Tuning Advisor
     - Optimizer in Tuning Mode
     - Create profiles for the statements
     - Can operate on a single SQL statement
4. Implement recommendations

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SQL Tuning Advisor

- Can be used in EM or on CLI (via `DBMS_SQLTUNE`)
- 2 Different tuning modes are available:
  - "Limited mode" will not generate a SQL Profile
  - "Comprehensive mode" runs through all possible analysis options
- SQL Profiles contain information that lead to improved execution plans without changing the application code
  - Use different optimizer settings
  - Correct wrong/missing statistics and wrong estimates
  - SQL Profiles are persistent
  - SQL Profiles don't change the original SQL statement
  - SQL Profiles can be transported within SQL Tuning Sets (STS)
    - See Note:751068.1 for an example
  - SQL Profiles can be tested and verified without any risk

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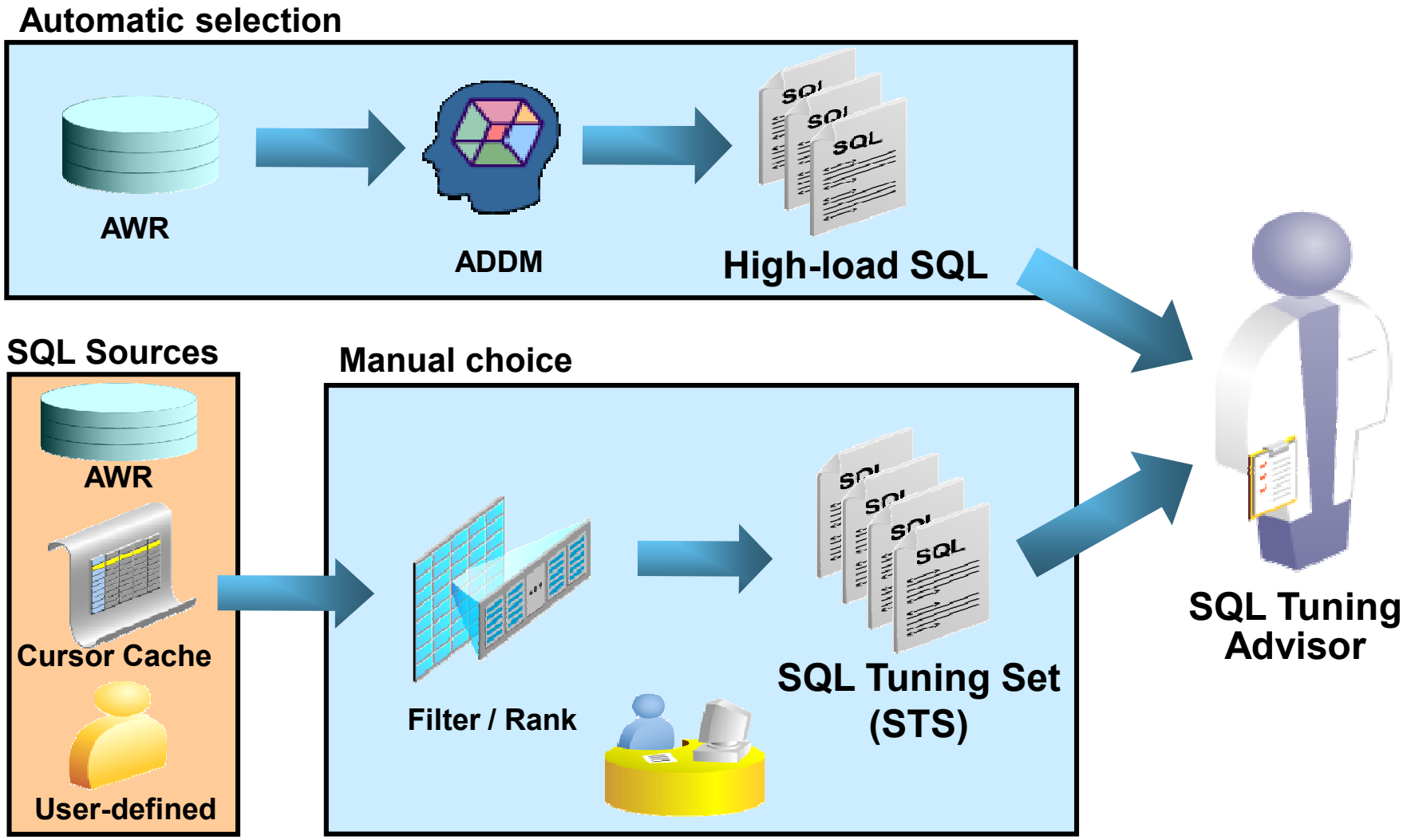
SQL Tuning - Sources



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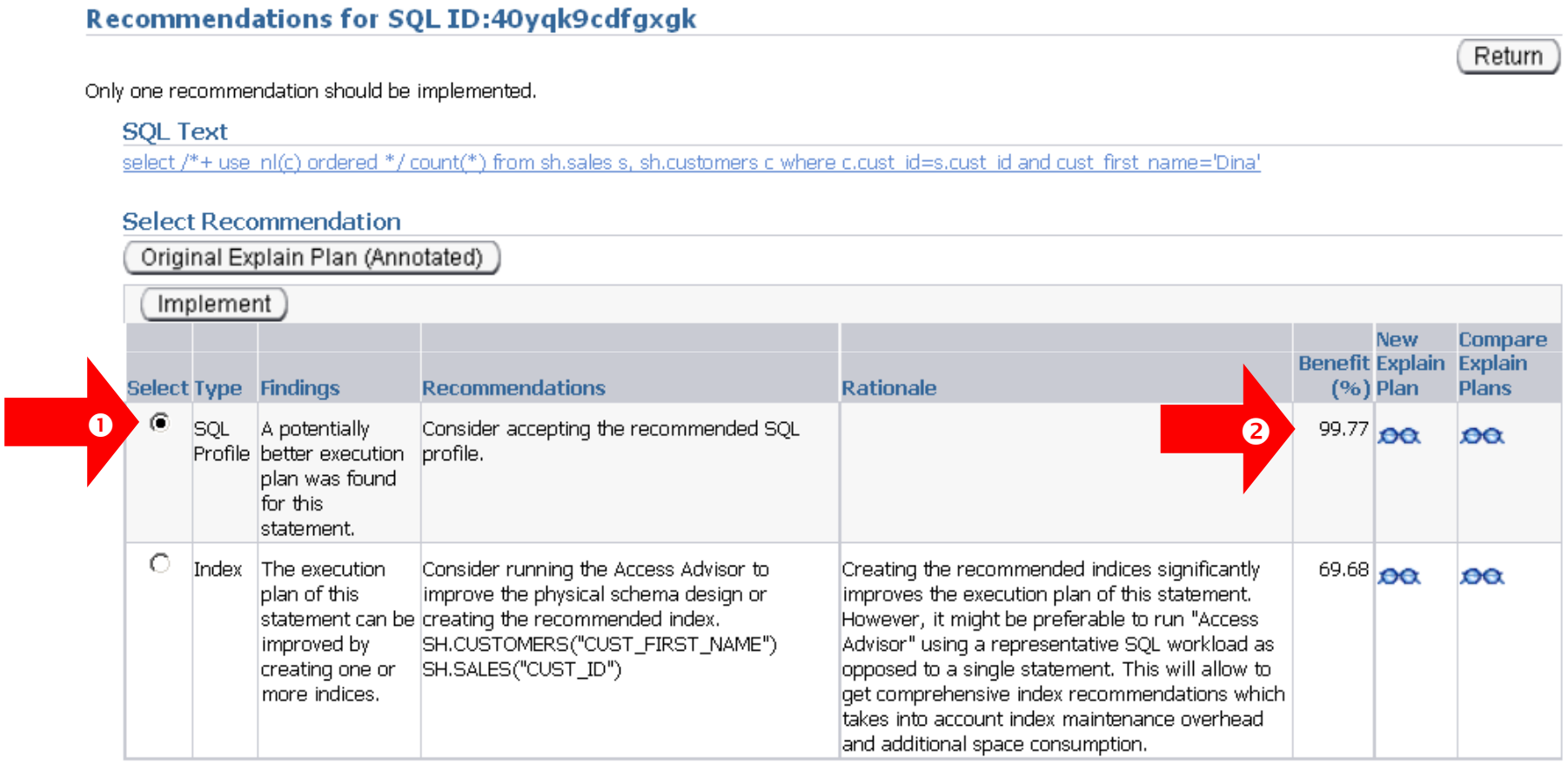
SQL Tuning

- Example: Results „Tuning Advisor“ ➔ SQL Profile



Recommendations for SQL ID:40yqk9cdfgxgk

Return

Only one recommendation should be implemented.

SQL Text

select /*+ use_nl(c) ordered */ count(*) from sh.sales s, sh.customers c where c.cust_id=s.cust_id and cust_first_name='Dina'

Select Recommendation

Original Explain Plan (Annotated)

Implement

Select	Type	Findings	Recommendations	Rationale	Benefit (%)	New Explain Plan	Compare Explain Plans
❶ ◉	SQL Profile	A potentially better execution plan was found for this statement.	Consider accepting the recommended SQL profile.	❷	99.77		
○	Index	The execution plan of this statement can be improved by creating one or more indices.	Consider running the Access Advisor to improve the physical schema design or creating the recommended index. SH.CUSTOMERS("CUST_FIRST_NAME") SH.SALES("CUST_ID")	Creating the recommended indices significantly improves the execution plan of this statement. However, it might be preferable to run "Access Advisor" using a representative SQL workload as opposed to a single statement. This will allow to get comprehensive index recommendations which takes into account index maintenance overhead and additional space consumption.	69.68		

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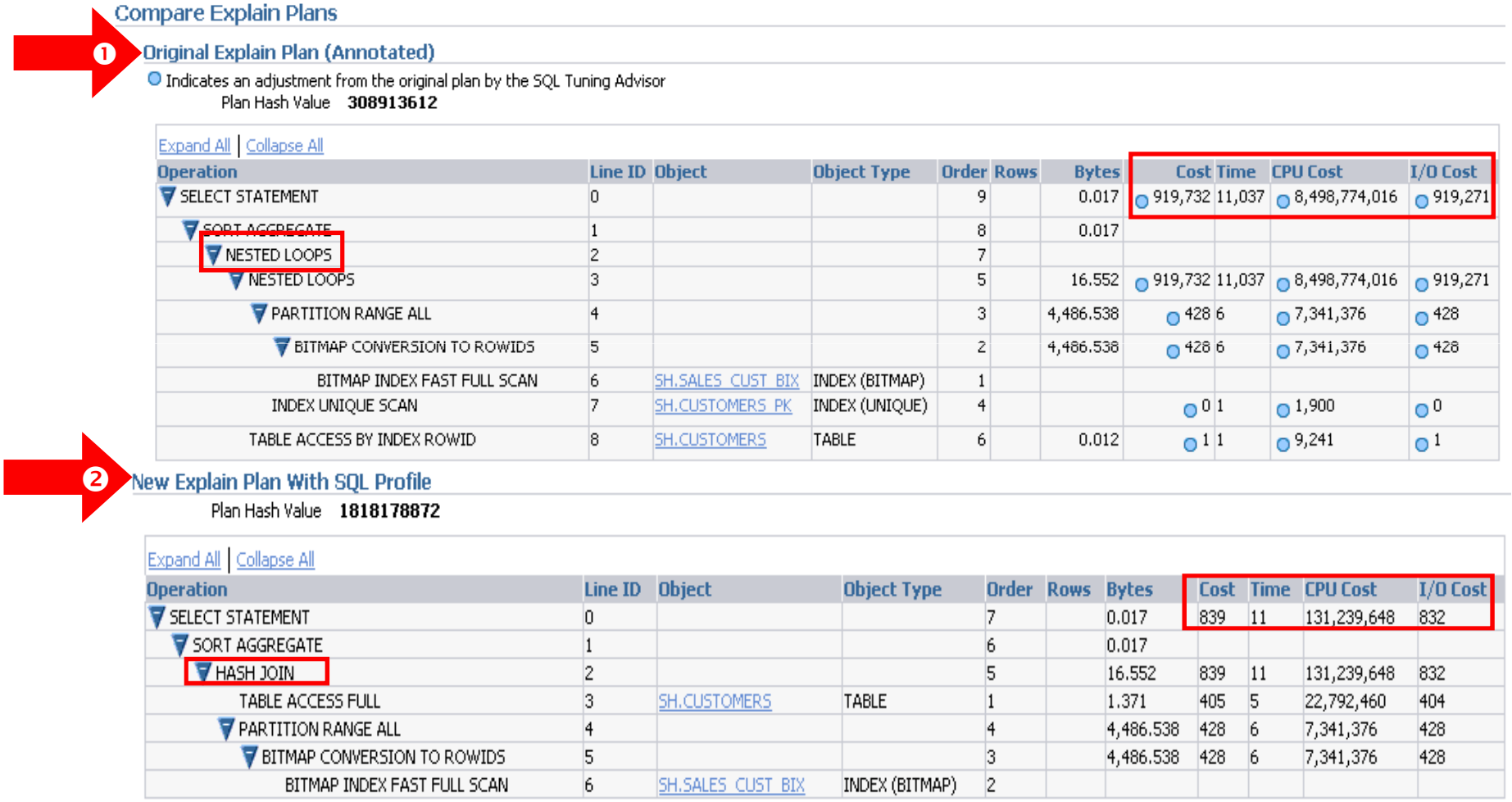
SQL Tuning

- Example: Compare original to new explain plan



Compare Explain Plans

1 Original Explain Plan (Annotated)

Indicates an adjustment from the original plan by the SQL Tuning Advisor

Plan Hash Value **308913612**

Expand All | Collapse All

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
SELECT STATEMENT	0			9		0.017	919,732	11,037	8,498,774,016	919,271
SORT AGGREGATE	1			8		0.017				
NESTED LOOPS	2			7						
NESTED LOOPS	3			5		16.552	919,732	11,037	8,498,774,016	919,271
PARTITION RANGE ALL	4			3		4,486.538	428	6	7,341,376	428
BITMAP CONVERSION TO ROWIDS	5			2		4,486.538	428	6	7,341,376	428
BITMAP INDEX FAST FULL SCAN	6	SH.SALES_CUST_BIX	INDEX (BITMAP)	1						
INDEX UNIQUE SCAN	7	SH.CUSTOMERS_PK	INDEX (UNIQUE)	4			0	1	1,900	0
TABLE ACCESS BY INDEX ROWID	8	SH.CUSTOMERS	TABLE	6		0.012	1	1	9,241	1

2 New Explain Plan With SQL Profile

Plan Hash Value **1818178872**

Expand All | Collapse All

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
SELECT STATEMENT	0			7		0.017	839	11	131,239,648	832
SORT AGGREGATE	1			6		0.017				
HASH JOIN	2			5		16.552	839	11	131,239,648	832
TABLE ACCESS FULL	3	SH.CUSTOMERS	TABLE	1		1.371	405	5	22,792,460	404
PARTITION RANGE ALL	4			4		4,486.538	428	6	7,341,376	428
BITMAP CONVERSION TO ROWIDS	5			3		4,486.538	428	6	7,341,376	428
BITMAP INDEX FAST FULL SCAN	6	SH.SALES_CUST_BIX	INDEX (BITMAP)	2						

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SQL Tuning with DBMS_SQLTUNE

- 4 steps to get an SQL Profile
  - `DBMS_SQLTUNE.CREATE_TUNING_TASK`
  - `DBMS_SQLTUNE.EXECUTE_TUNING_TASK`
  - `DBMS_SQLTUNE.REPORT_TUNING_TASK`
  - `DBMS_SQLTUNE.ACCEPT_SQL_PROFILE`

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SQL Tuning - DBMS_SQLTUNE

Tuning Task Management

- CANCEL_TUNING_TASK
- CREATE_TUNING_TASK
- DROP_TUNING_TASK
- EXECUTE_TUNING_TASK
- IMPLEMENT_TUNING_TASK
- INTERRUPT_TUNING_TASK
- REPORT_AUTO_TUNING_TASK
- REPORT_TUNING_TASK
- RESUME_TUNING_TASK
- SCRIPT_TUNING_TASK
- RESET_TUNING_TASK
- SET_TUNING_TASK_PARAMETER

Staging Table Management

- CREATE_STGTAB_SQLPROF
- CREATE_STGTAB_SQLSET
- PACK_STGTAB_SQLPROF
- PACK_STGTAB_SQLSET
- REMAP_STGTAB_SQLPROF
- REMAP_STGTAB_SQLSET
- UNPACK_STGTAB_SQLPROF
- UNPACK_STGTAB_SQLSET

SQL Profile Management

- ACCEPT_SQL_PROFILE
- ALTER_SQL_PROFILE
- DROP_SQL_PROFILE

Select SQL Statements

- CAPTURE_CURSOR_CACHE_SQLSET
- SELECT_CURSOR_CACHE
- REPORT_SQL_MONITOR
- SELECT_WORKLOAD_REPOSITORY
- SQLTEXT_TO_SIGNATURE

SQL Tuning Set Management

- ADD_SQLSET_REFERENCE
- CREATE_SQLSET
- DELETE_SQLSET
- DROP_SQLSET
- LOAD_SQLSET
- REMOVE_SQLSET_REFERENCE
- SELECT_SQLSET
- UPDATE_SQLSET

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SQL Tuning Task Command Line Example

```
exec DBMS_SQLTUNE.DROP_TUNING_TASK('my_tuning_task');

DECLARE
 my_task_name VARCHAR2(30);
 my_sqltext CLOB;
BEGIN
 my_sqltext := q'!<your SQL - concatenate lines with ||>!';
 my_task_name := DBMS_SQLTUNE.CREATE_TUNING_TASK(sql_text =>  my_sqltext,
                 user_name => XY,scope => 'COMPREHENSIVE',time_limit => 60,
                 task_name => 'my_tuning_task', description => 'test');
END;
/

exec DBMS_SQLTUNE.EXECUTE_TUNING_TASK( task_name => 'my_tuning_task' );

SELECT sofar, totalwork FROM V$ADVISOR_PROGRESS WHERE task_id =
 (SELECT task_id FROM USER_ADVISOR_TASKS WHERE task_name='my_tuning_task');

SET LONG 100000
SET LONGCHUNKSIZE 100000
SET LINESIZE 10000
SET PAGESIZE 10000
SELECT DBMS_SQLTUNE.REPORT_TUNING_TASK( 'my_tuning_task') FROM DUAL;
```

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SQL Profile containing literals - not binds

- SQL Profiles can handle statements containing literals (instead of binds) as well:
  - Since 11.1.0.6 possible in EM:

  - In 10.2 only possible on command line:

```
exec
:p_name:=dbms_sqltune.accept_sql_profile
(task_name=>'XT',name=>'XT_PROFILE', FORCE_MATCH=>TRUE);
```

```
SQL> select name, status, force_matching, sql_text
       from dba_sql_profiles;

NAME     STATUS   FOR  SQL_TEXT
------- -------- ---- ----------------------------------------
MY_PROF ENABLED  YES  select /*+ use_nl(c) ordered */ count(*)
                           from sh.sales s, sh.customers c
                           where c.cust_id = s.cust_id
                                 and CUST_FIRST_NAME = 'Mike'
```

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SQL Profile - evaluation

- SQL Profiles should be evaluated before making them available to every user:

```
exec
:p_name:=dbms_sqltune.accept_sql_profile
task_name=>'XT',name=>'XT_PROFILE',
category=>'TEST_ENV', FORCE_MATCH=>TRUE)
```

```
alter session set SQLTUNE_CATEGORY='TEST_ENV';
```

- Now evaluate the statement's profile in a limited user context
- If verification went fine, make it accessible to everybody

```
exec
dbms_sqltune.alter_sql_profile
(name=>'XT_PROFILE',
 attribute_name=>'CATEGORY',value=>'DEFAULT')
```

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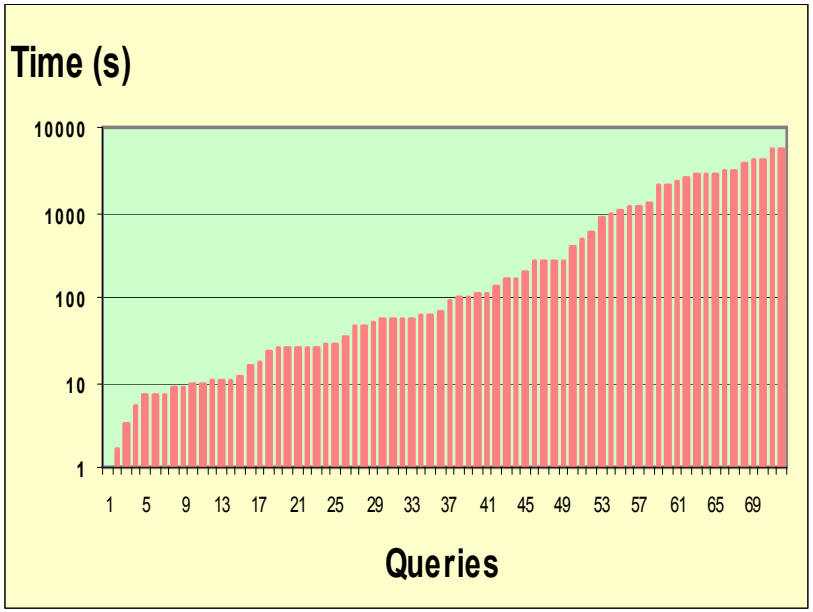
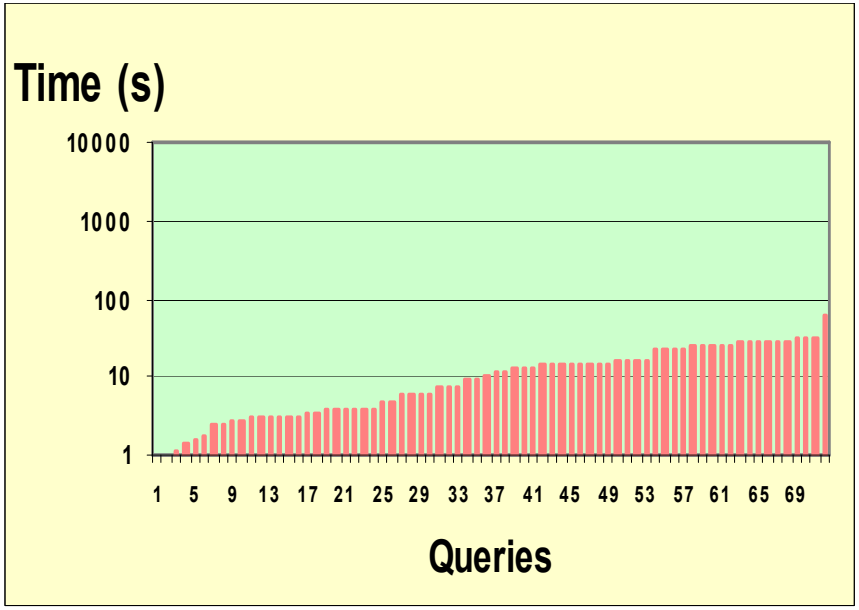
SQL Profiling Effectiveness

- Workload of a big market research customer in EMEA - 73 high load queries identified requiring tuning
  - Query execution time Before vs. After

Before ...



... After



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SQL Profiling Effectiveness

- Workload of a big market research customer in EMEA - 73 high load queries identified requiring tuning
  - Manual tuning compared to automatic tuning of these 73 complex DWH statements

	Average Response Time	Worst Response Time	Cumulative Response Time
No Tuning	817s	5751s	58821s
Manual Tuning	30s	275s	2131s
Automatic Tuning (SQL Pr)	13s	59s	929s

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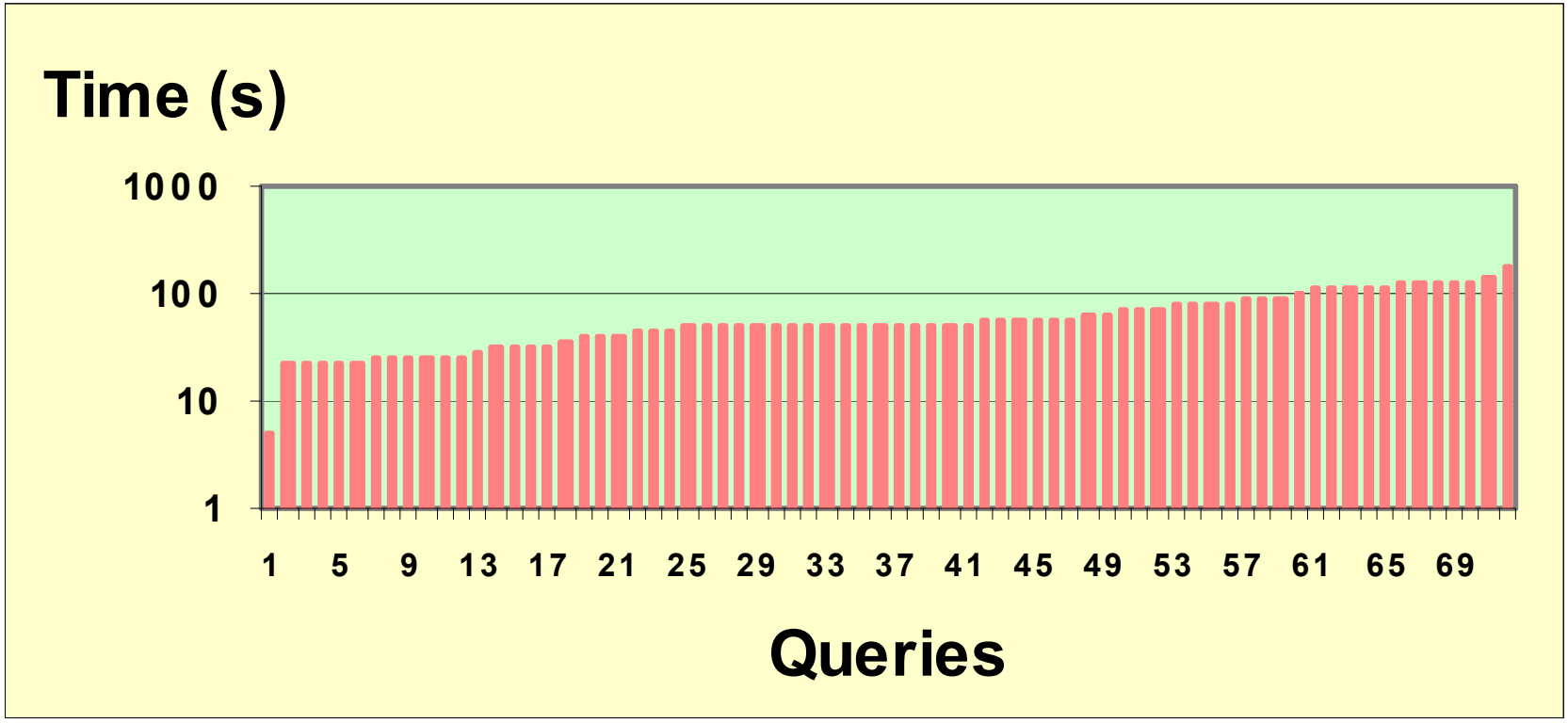
SQL Profiling Time

- All together the optimization for all 73 statements took approximately 1½h !!!



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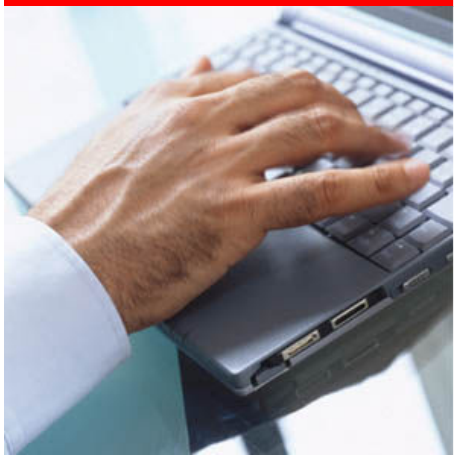
Agenda



- Preparation
- Installation
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
- Best Practices

Challenges
SQL Plan Management
Database Replay
SQL Performance Analyzer

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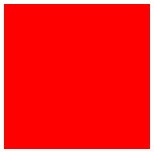

Challenges

- >90% of so-called upgrade problems aren't really upgrade problems but performance issues after the upgrade
  - It's important to use sufficient test scenarios and methods
  - Typical problem areas:
    - Optimizer - execution plans
      - Queries are slow
      - Reports or batches take longer to complete
    - Increased resource requirements
    - Code path changes

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Challenges

- Optimizer - prevent execution plan changes:
  - Classical approach:
    - Rule Based Optimizer (RBO desupport since Oracle 10*g* - Note:189702.1)
    - Hints
    - Stored Outlines
    - Rewriting SQL statements
    - `optimizer_features_enabled=n.n.n`
    - Change specific optimizer parameters
    - Import and fix object and systems statistics
  - Modern, efficient and better resource consumption:
    - SQL Plan Management
    - SQL Profiling

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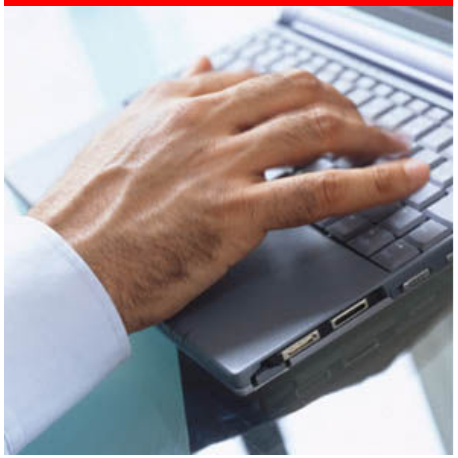
Agenda



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Challenges
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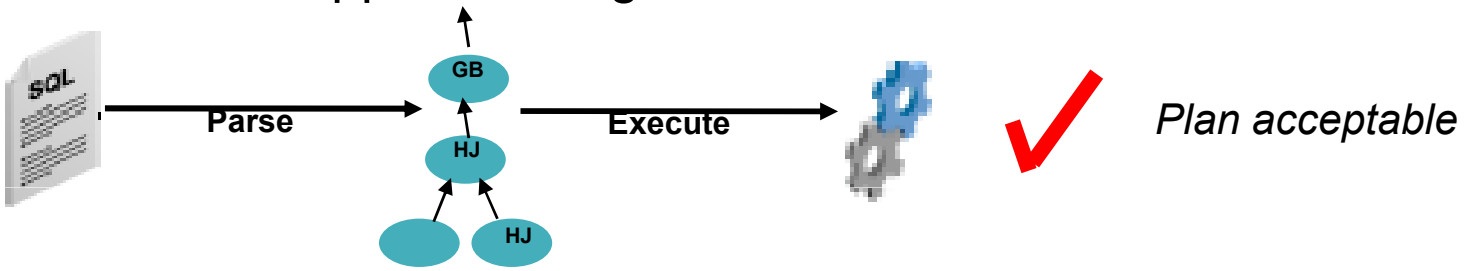
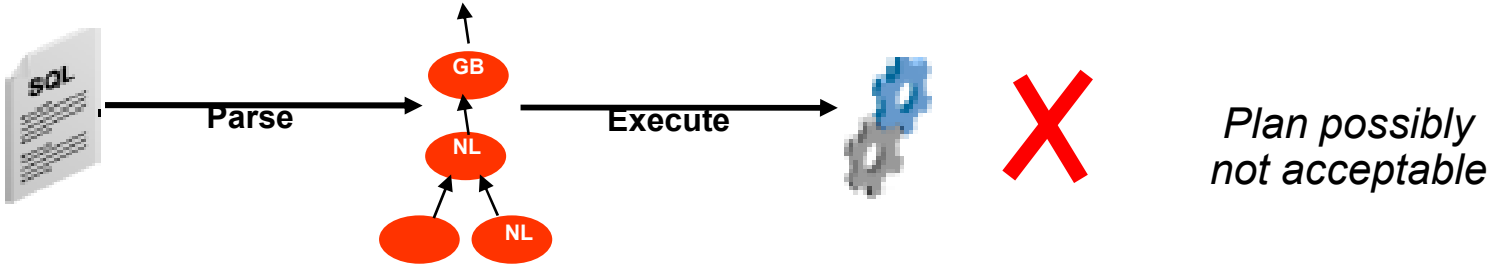
Without SQL Plan Management

- Challenging to "freeze" execution plans and statistics
- Difficulty:
  - Statement has been parsed and a plan got created
    Verification happens during execution:



  - Now some conditions get changed (statistics, upgrade, parameters)
    - A new plan will be created - is it better or worse???



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SQL Plan Management

- First preventive and fully transparent database mechanism to ensure plan stability
- SQL execution plans will be recorded
- A SQL Baseline will be created
  - Consist of accepted execution plans
  - Contains only plans for statements being parsed/executed more than once
- Only known, verified and accepted plans will be used
- Package: **DBMS_SPM**

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SQL Plan Management

- 3 phases for plan stability:
  - Capture
    - Create a SQL Baseline representing trusted execution plans
      - Baseline is stored in SQL Management Base in SYSAUX
  - Selection
    - Only accepted plans will be used
    - New execution plans will be recorded to the plan history
  - Evolution
    - Evaluate all unverified plans for a given statement in the plan history to become either accepted or rejected

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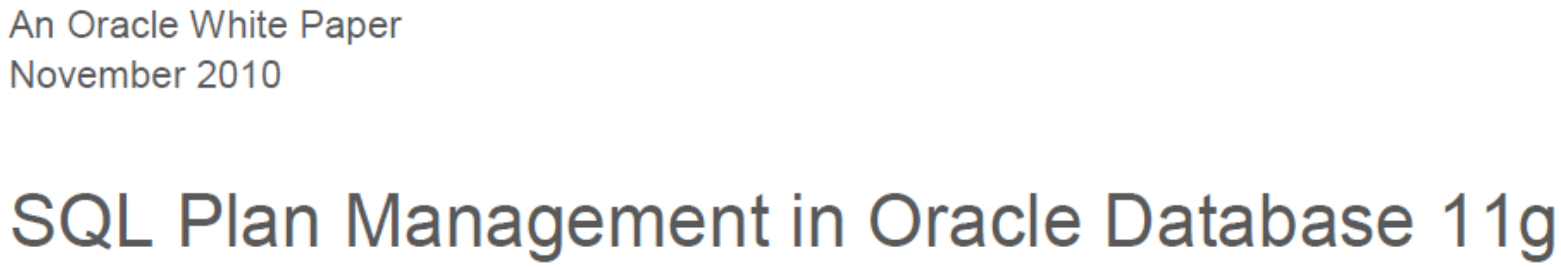
SQL Plan Management

- White Paper:
  - http://www.oracle.com/technetwork/database/focus-areas/bi-datawarehousing/twp-sql-plan-management-11gr2-133099.pdf



- MOS Notes:
  - Note:456518.1 SQL Plan Management – Example
  - Note:789888.1 How to load plans from AWR into SPM
  - Note:801033.1 How to move 10.2 plans into 11g SPM

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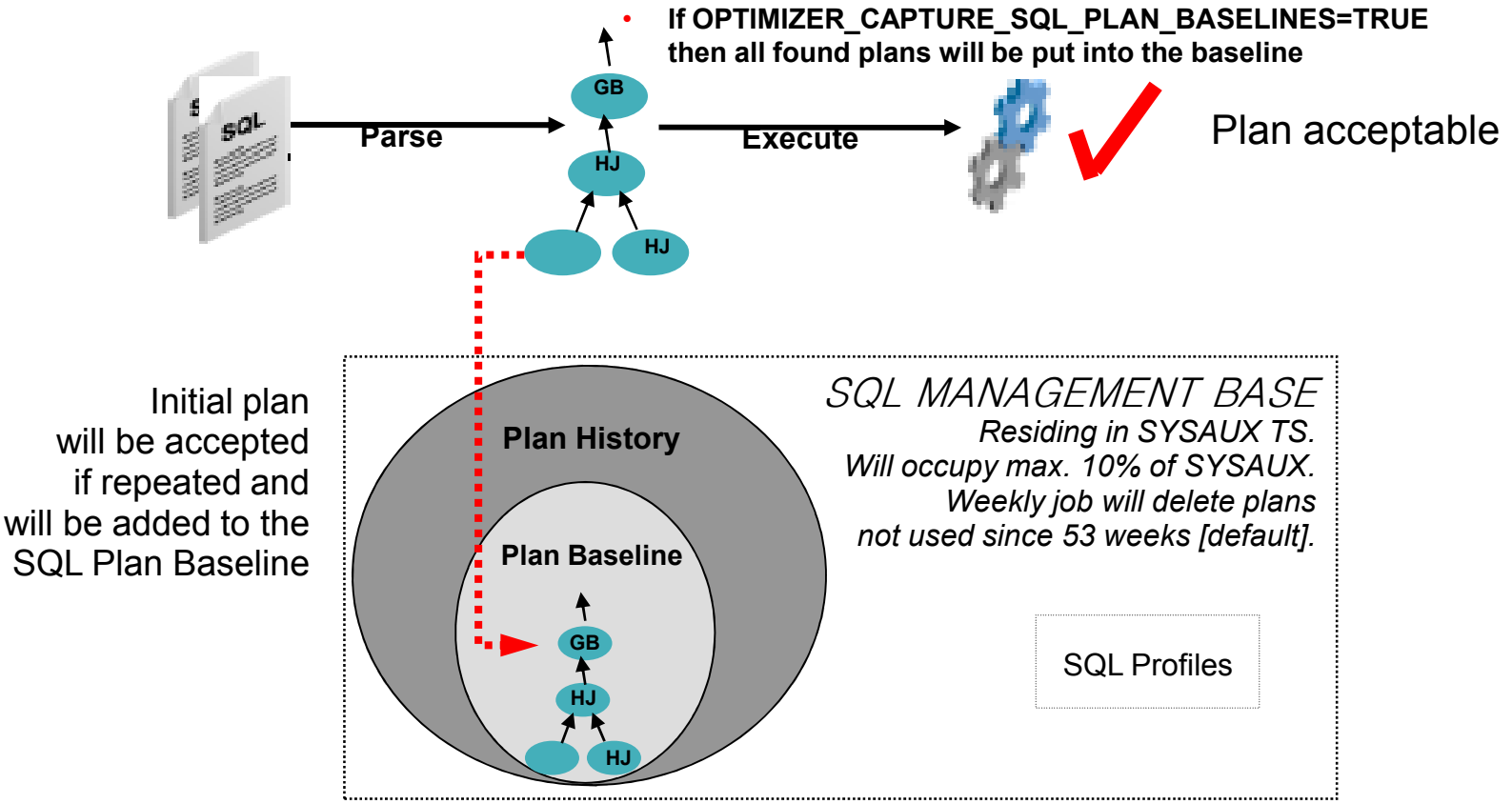
SQL Plan Management

- Phase 1 – Baseline Capture
  - Schematically - `OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES=TRUE`



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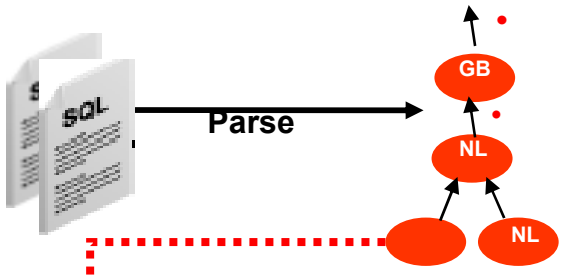
SQL Plan Management

- Phase 2 - Selection
  - Same statement parsed again but a different plan will be created

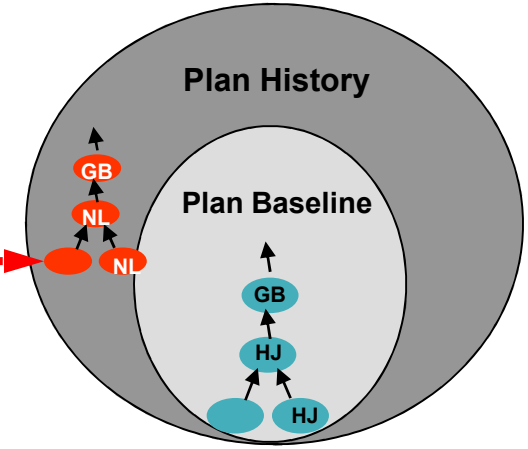


`OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES=FALSE` is set the its default

Annotation:

If `OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES=TRUE` then this plan would have been added to the baseline

New plan will be added to the Plan History but it won't be used unless it has been verified



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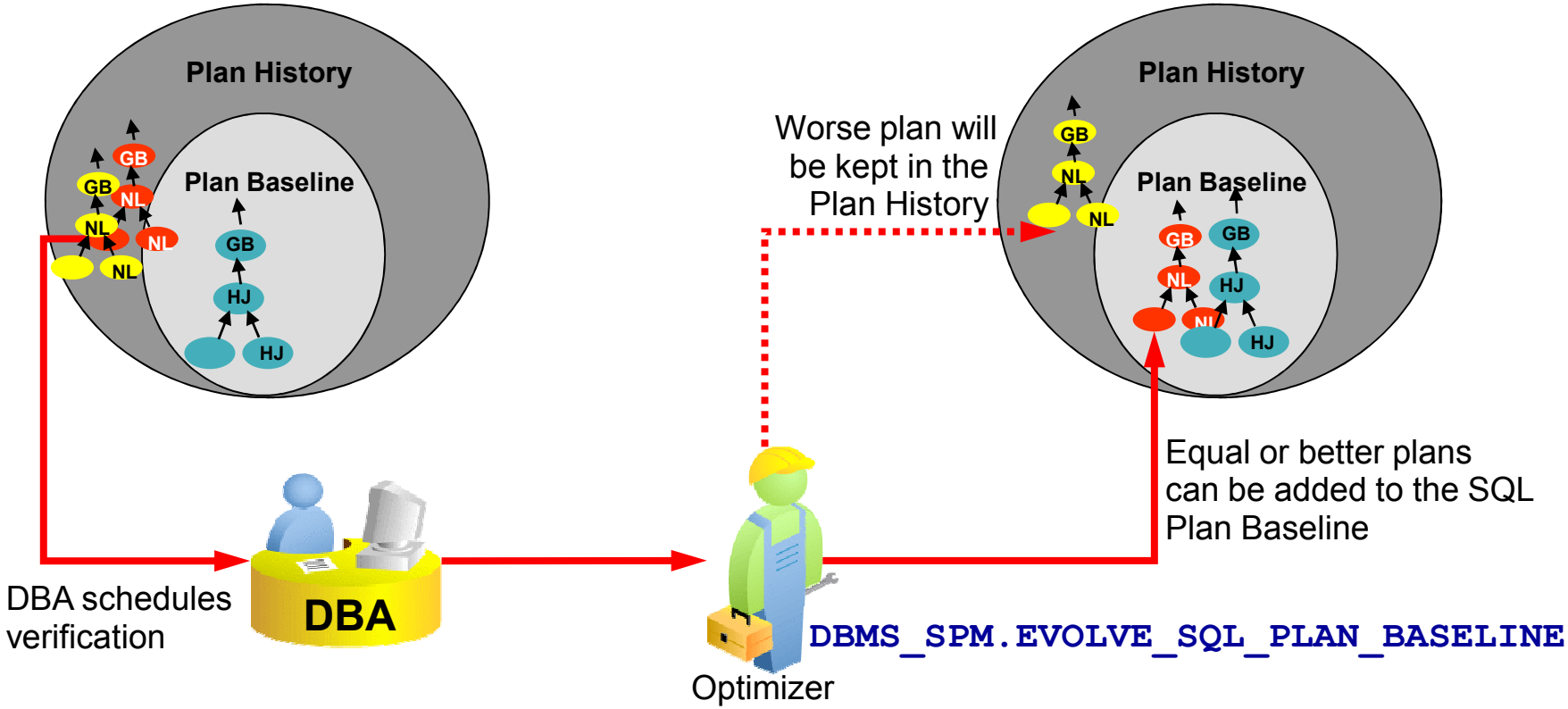
SQL Plan Management

- Phase 3 - Evolution
  - Schematically:



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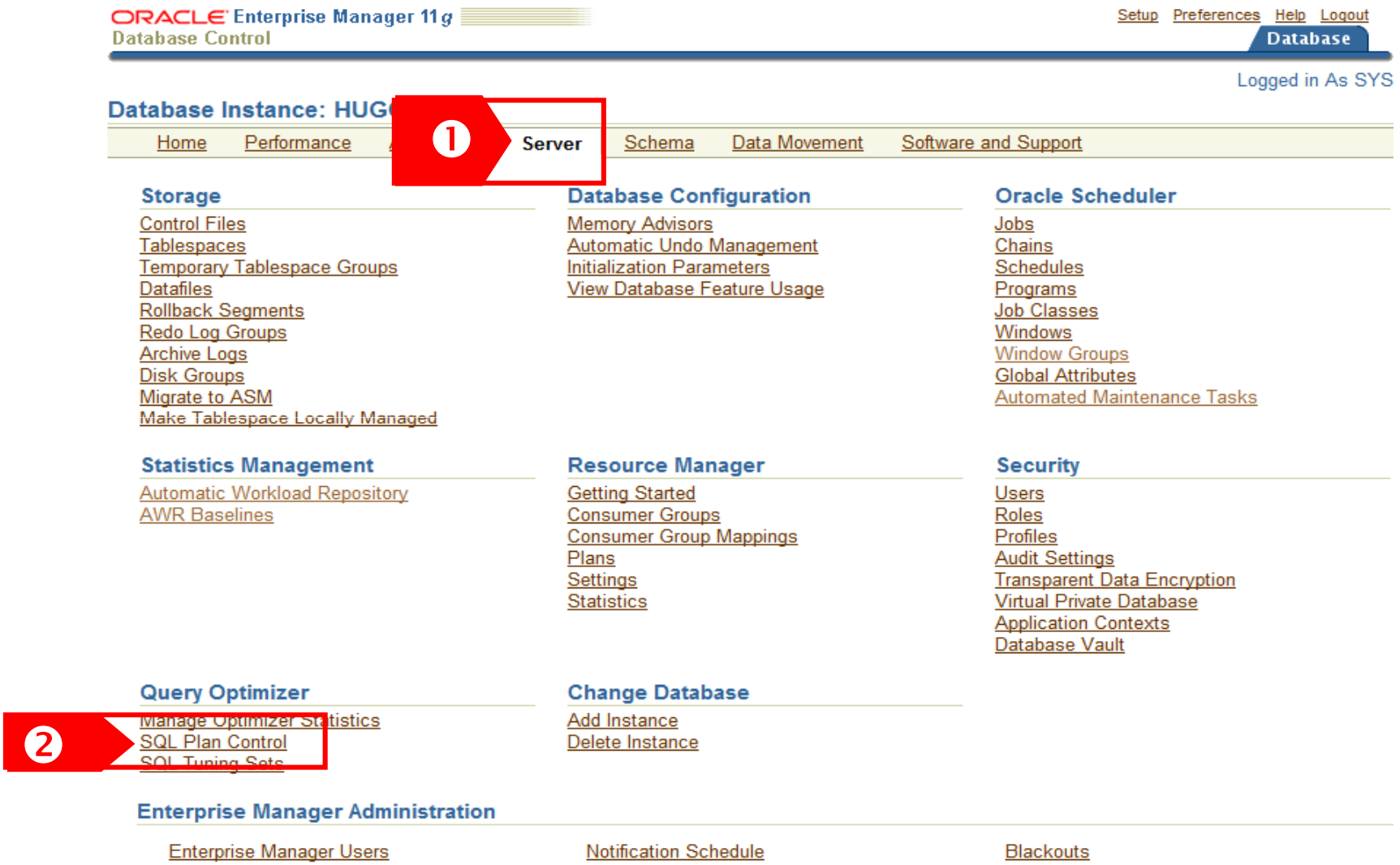
SQL Plan Management



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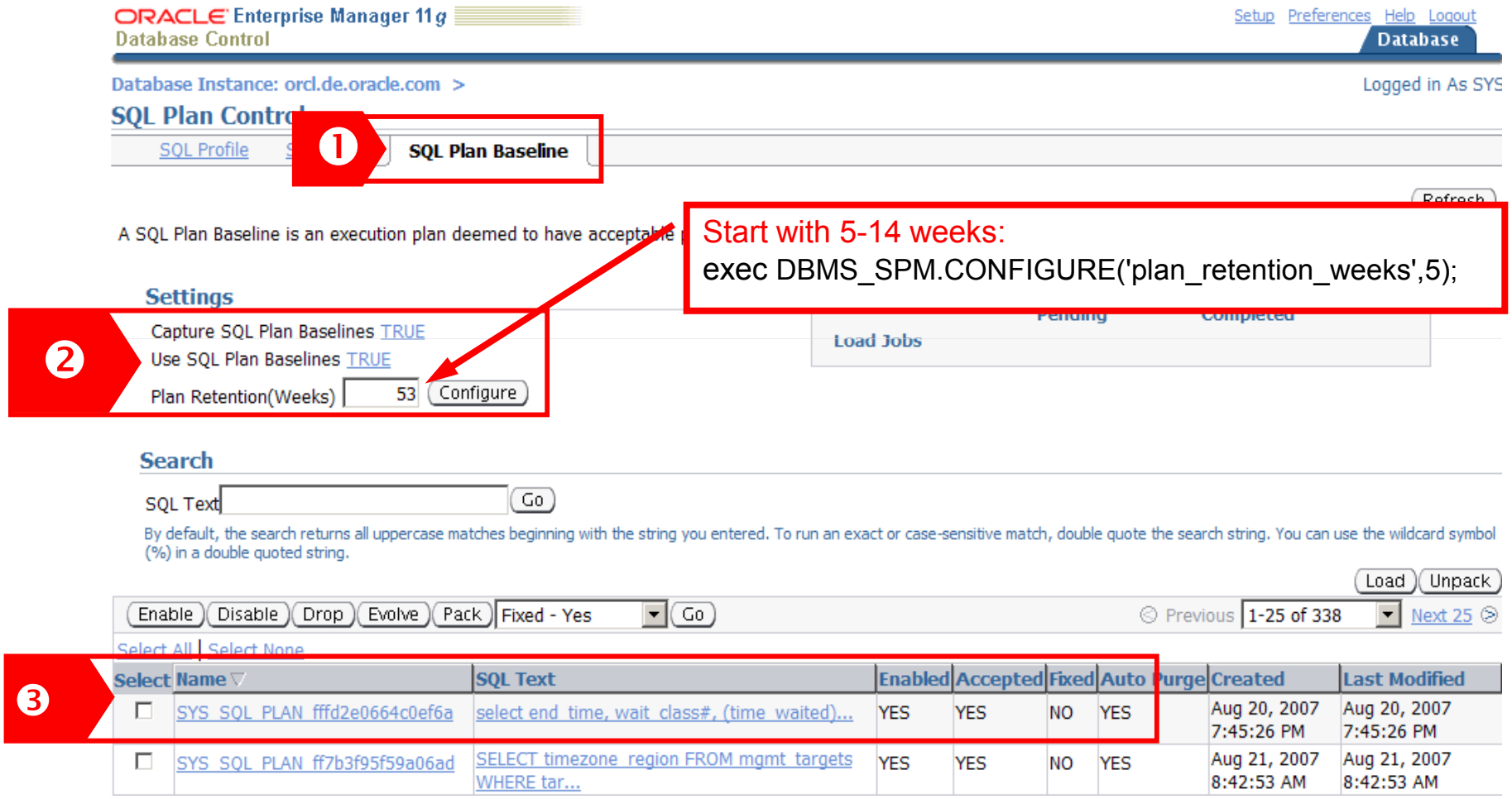
SQL Plan Management

- DatabaseControl - Configuration:



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SQL Plan Management - Scenarios

- Upgrade scenario 1:
  - Parameterize the optimizer back to the "old" behaviour
  - Works for all database releases since 8.0.3
- Upgrade scenario 2:
  - Create stored outlines and use them to record your plans in 11g
- Upgrade scenario 3:
  - Transport the well known plans to the new release
  - Works since 10*gR2*
- Ship a new application (module) along with appropriate SQL plan baselines:
  - Ship the best execution plans for the new statements within a staging table and ensure that they'll be used
  - Works since 11g

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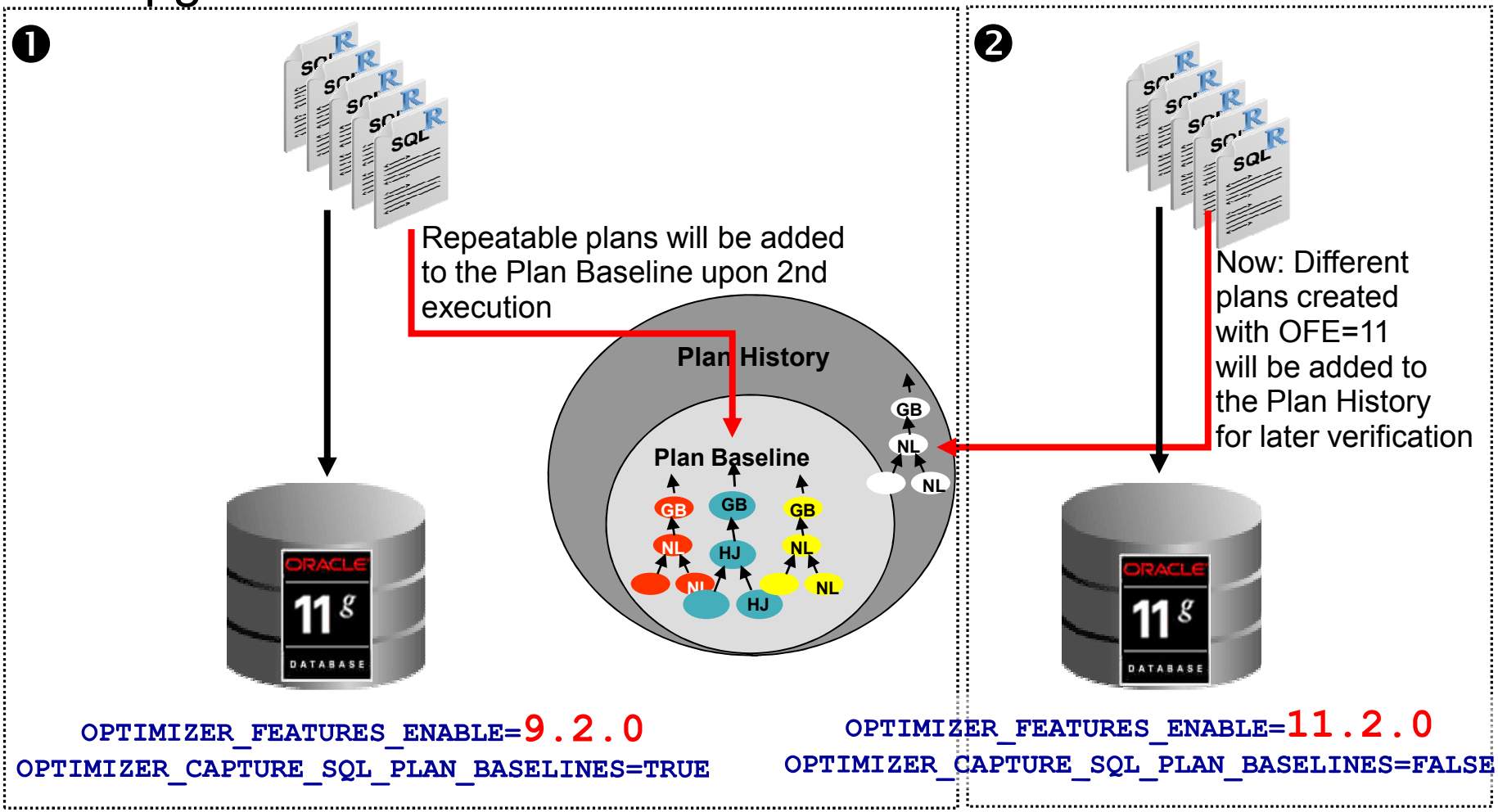
SQL Plan Management – Upgrade/OFE

- Upgrade scenario 1



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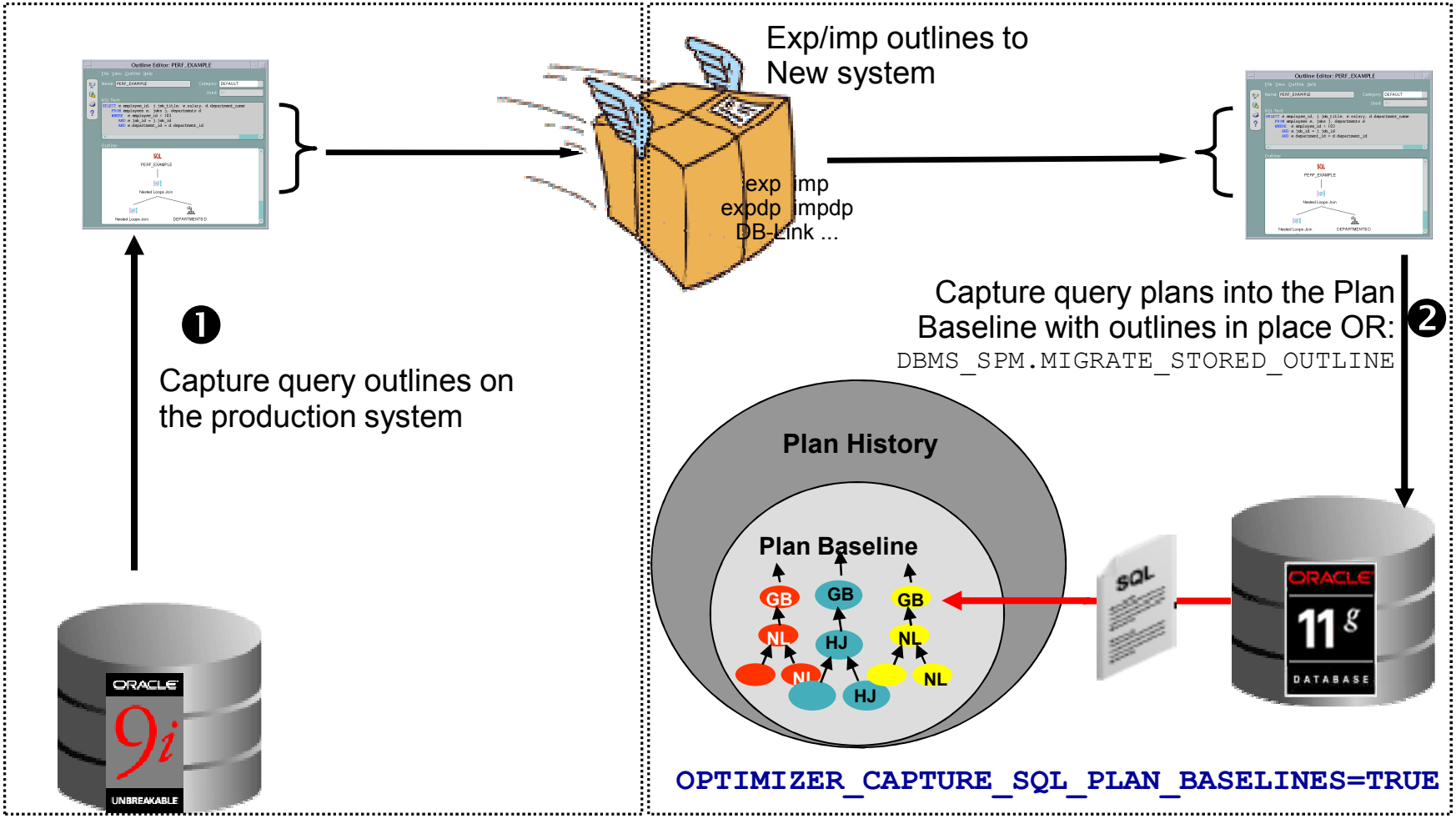
SQL Plan Management – Upgrade/Outlines

- Upgrade scenario 2



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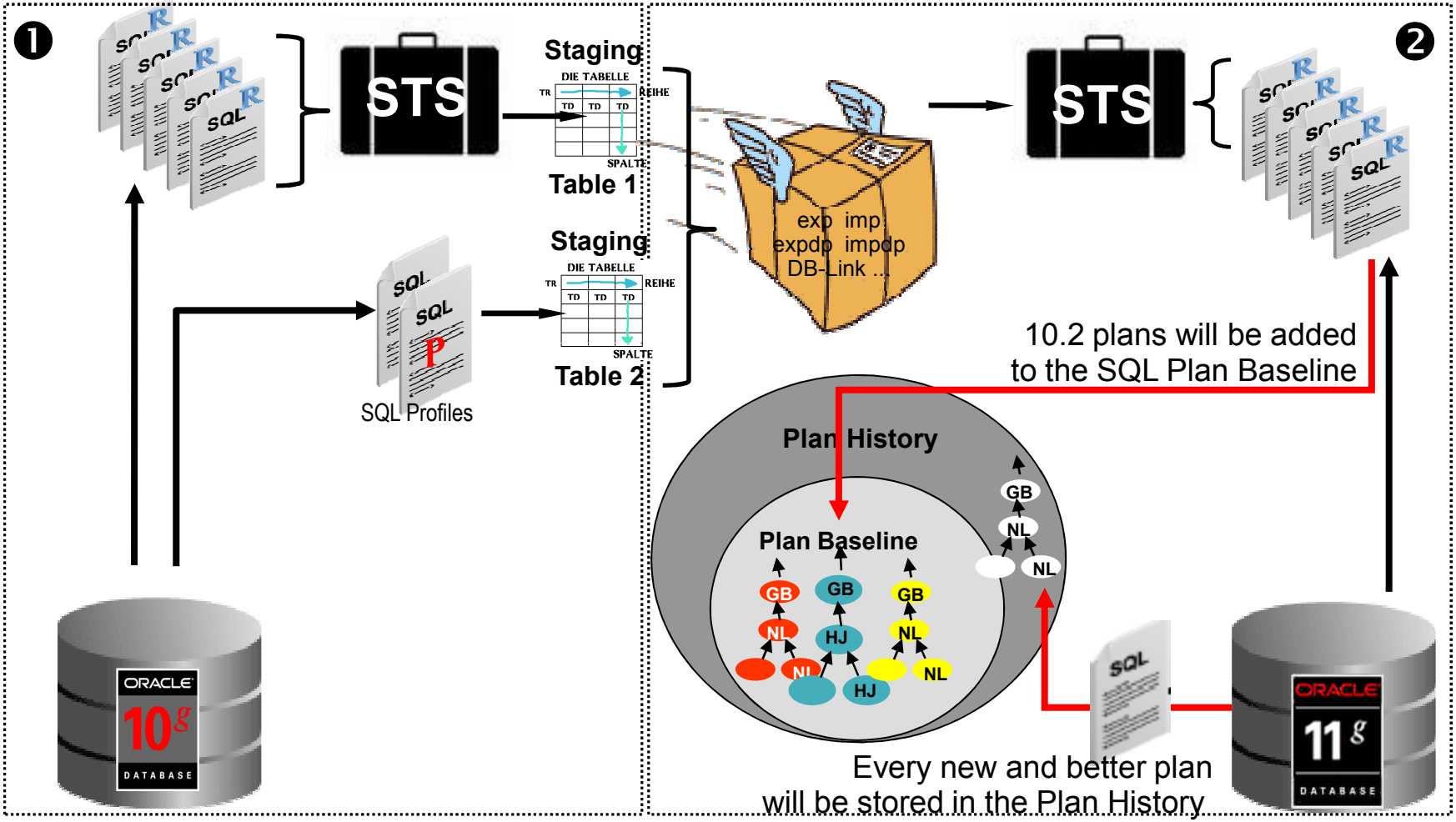
SQL Plan Management - Upgrade

- Upgrade scenario 3



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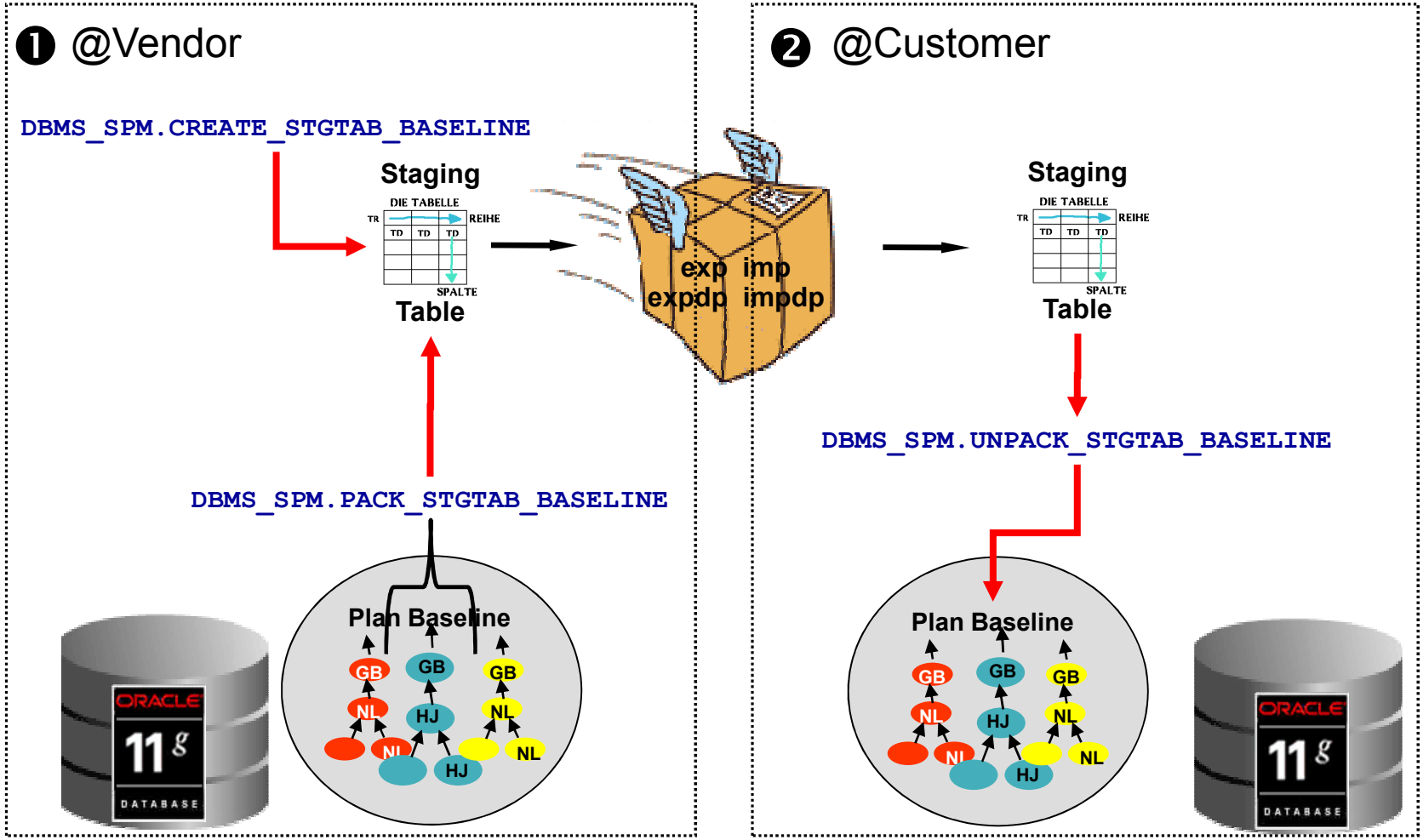
SQL Plan Management - New Application

- New application (module) gets delivered



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SQL Plan Management - New Application

- New application (module) gets delivered - and it's possible to deliver the right execution plans, too:
  - @Software Vendor:
    - Create a staging table using **DBMS_SPM.CREATE_STGTAB_BASELINE**
    - Pack the required baselines into the staging table using **DBMS_SPM.PACK_STGTAB_BASELINE**
    - Export the staging table into a dump file using Data Pump or Export and transport it to the destination system
  - @Customer:
    - Import the dump file into the destination database
    - Unpack the SQL Plan Baselines from the staging table into the SQL Management Base of the target system
      - **DBMS_SPM.UNPACK_STGTAB_BASELINE**

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SQL Plan Management - Outlines

- Oracle 11.2 supports simple Stored Outline migration
  - `DBMS_SPM.MIGRATE_STORED_OUTLINE`
  - `http://download.oracle.com/docs/cd/E11882_01/server.112/e10821/optplanmgmt.htm#PFGRF3616`
- Oracle 11*g*: Manual migration of Stored Outlines to SQL Plan Management:
  - Tuning-Pack:
    Record execution plans in 10.2 and transport them (see Upgrade Case 1)
  - No Tuning-Pack license:
    - Upgrade your database with Outlines to 11g
    - Set CAPTURE_SQL_PLAN_BASELINES=TRUE
    - Make sure your run your outlined queries 2x
      - Plans will be recorded to the Baseline
    - Switch CAPTURE_SQL_PLAN_BASELINES=FALSE
    - Delete the Stored Outlines

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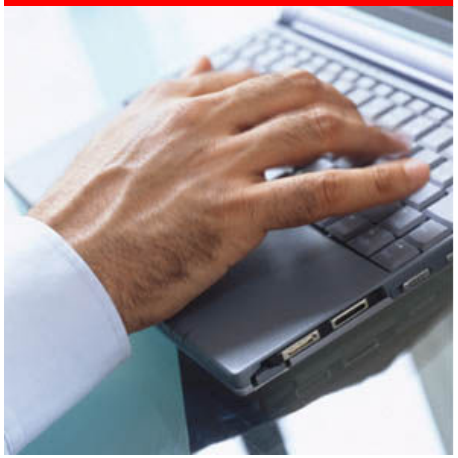
Agenda



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SQL Performance Analyzer

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Real Application Testing

- Goal:
  - Record and replay a real workload to see how the new system performs
  - Find regressions and changing plans **before** the upgrade

- Licensable database pack "Real Application Testing"
  - ⇨ Available since Oracle Database 11.1.0.6
  - ⇨ Available with patch set 10.2.0.4/5
  - ⇨ Available as single patch for 9.2.0.8 and 10.2.0.2/3
    - ⇨ For patch numbers please see Note:560977.1

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Real Application Testing

- Real Application Testing consists of:
  - Database Replay
    - Package **DBMS_WORKLOAD_CAPTURE**
      - ⇨ Capture works in 9.2.0.8 and 10.2.0.2/3/4/5 and 11.1.0.x and 11.2.0.x
    - Package **DBMS_WORKLOAD_REPLAY**
      - ⇨ Replay works in 11.1.0.x and 11.2.0.x
  - SQL Performance Analyzer (SPA)
    - Package **DBMS_SQLPA**
      - ⇨ Collecting statements works in:
        - ⇨ 9.2.0.x and 10.1. 0.x with sql tracing
        - ⇨ 10.2.0.2/3/4/5 and 11.1.0.x and 11.2.0.x by capturing from cursor cache
      - ⇨ Evaluation and comparison works with:
        - ⇨ 10.2.0.2/3/4/5 and 11.1.0.x and 11.2.0.x
  - SQL Tuning Sets (STS)
    - Package **DBMS_SQLTUNE**

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Real Application Testing

- White Paper:
  - Database Replay:
    - http://www.oracle.com/technetwork/database/features/manageability/db-replay-white-paper-ow07-1-2-133325.pdf
  - SQL Performance Analyzer:
    - http://www.oracle.com/technetwork/database/features/performance/spa-white-paper-ow07-132047.pdf
  - OTN:
  - http://www.oracle.com/technetwork/database/features/manageability/index.html
  - Command line examples for REPLAY and SPA:
    - http://www.oracle.com/technetwork/database/features/manageability/db-replay-cli-128678.zip
    - http://www.oracle.com/technetwork/database/features/manageability/spa-scripts-128620.zip

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Real Application Testing

- Database Control:

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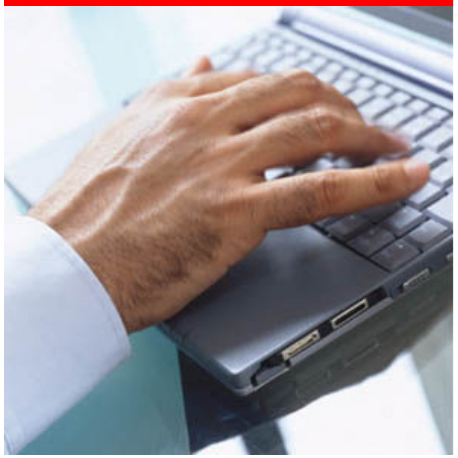
Agenda



- Preparation
- Installation
- Upgrade
- News and Task List
- Diagnostics & Tuning
- Performance Testing
  - Challenges
  - SQL Plan Management
  - Database Replay
  - SQL Performance Analyzer
- Best Practices

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Database Replay

- Replay actual production database workload in test environment
- Identify, analyze and fix potential instabilities before making changes to production

- Capture Workload in Production
  - Capture full production workload with real load, timing & concurrency characteristics
  - Move the captured workload to test system
- Replay Workload in Test
  - Make the desired changes in test system
  - Replay workload with full production characteristics
  - Honor commit ordering
- Analyze & Report
  - Errors
  - Data divergence
  - Performance divergence

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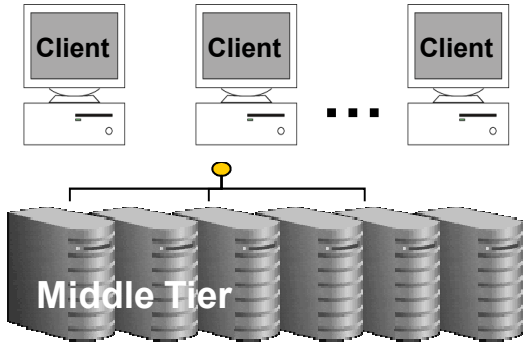
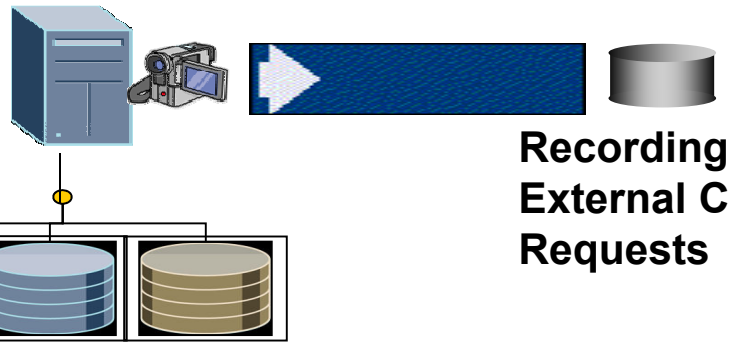
Supported Changes

Changes Unsupported



Changes Supported

- Database Upgrades, Patches
- Schema, Parameters
- RAC nodes, Interconnect
- OS Platforms, OS Upgrades
- CPU, Memory
- Storage
- Etc.

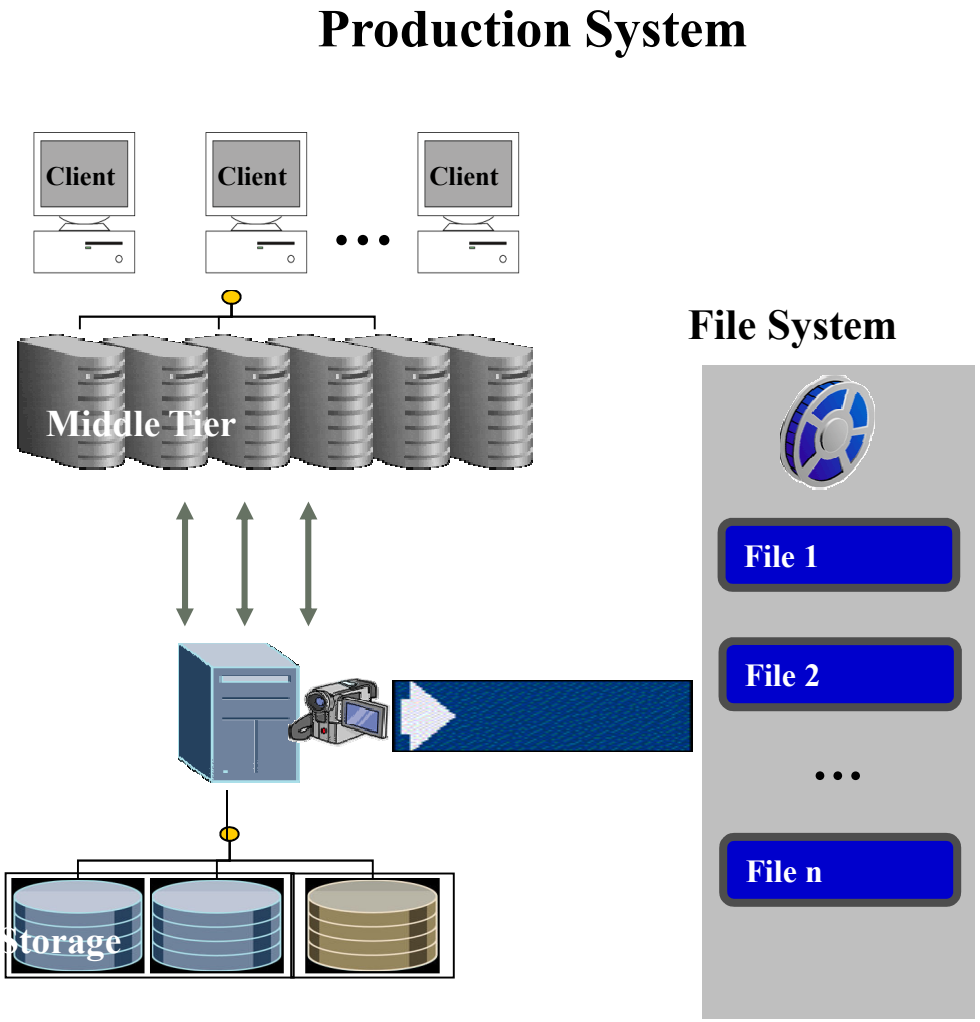


Recording of External Client Requests

†Shared Server support from Oracle Database Release 11.2

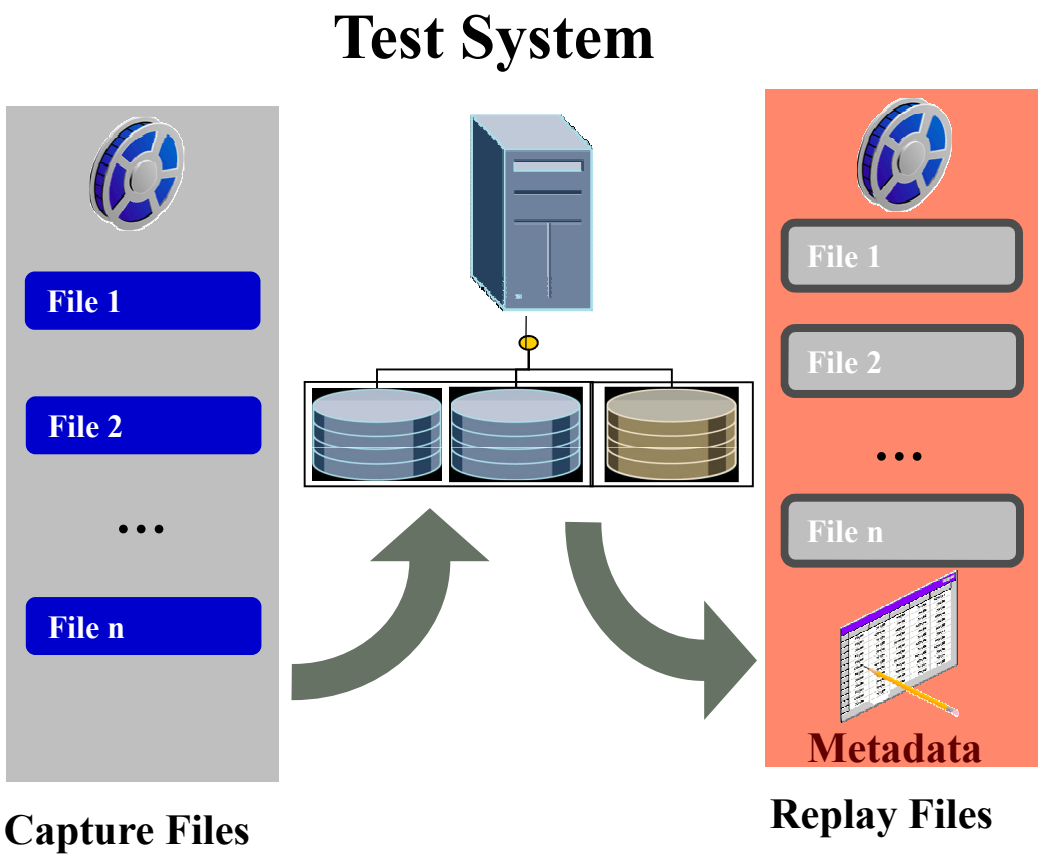
Step 1: Workload Capture

- All external client requests captured in binary files
- System background and internal activity excluded
- Minimal overhead
  - Avoids function call when possible
  - Buffered I/O
- Independent of client protocol
- Can capture on 9.2.0.8 and replay on 11g
- Capture load for interesting time period, e.g., peak workload, month-end processing, etc.



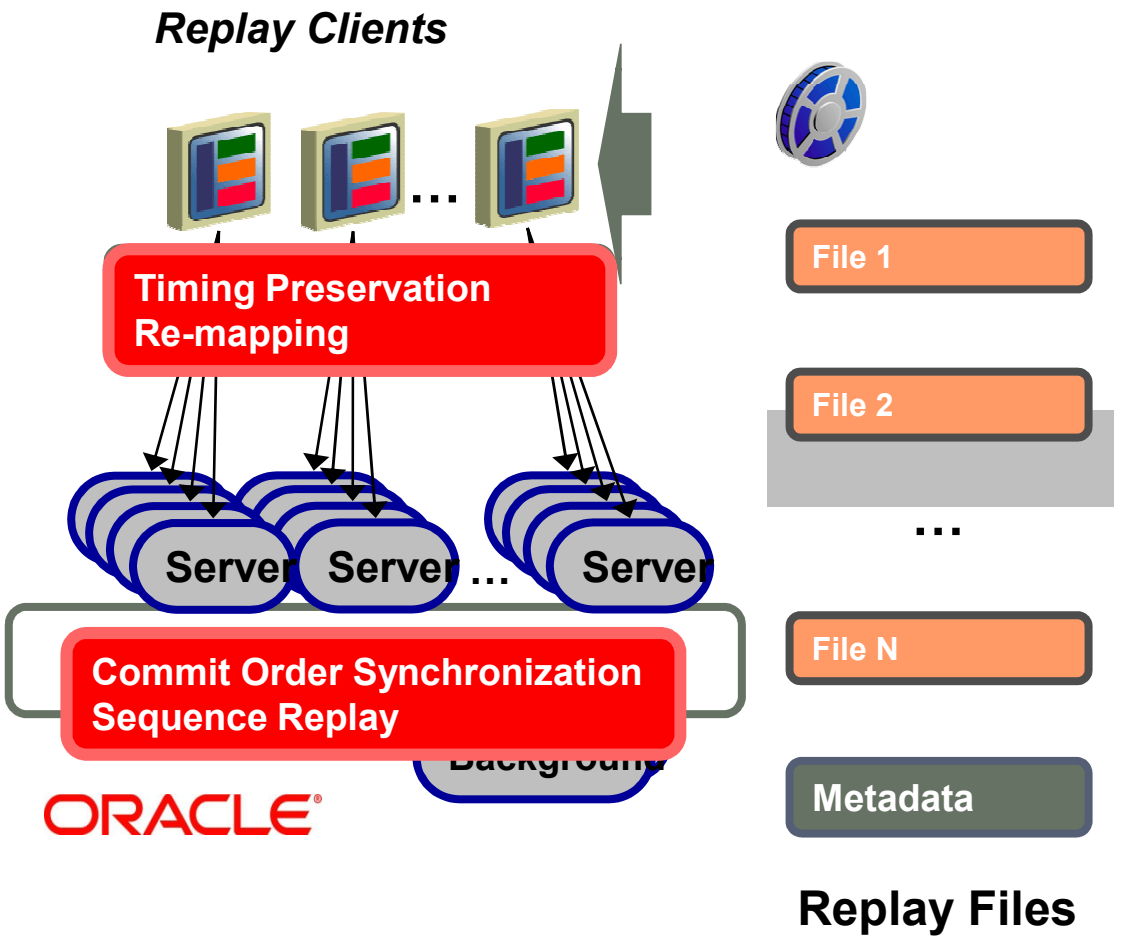
Step 2: Process Workload Files

- Setup test system
  - Application data should be same as production system as of capture start time
  - Use RMAN, Snapshot Standby, imp/exp, Data Pump, etc. to create test system
  - Make change: upgrade db and/or OS, change storage, migrate platforms, etc.
- Processing transforms captured data into replayable format
- Once processed, workload can be replayed many times
- For RAC copy all capture files to single location for processing



Step 3: Replay Workload

- Replay captured workload
  - Replayed operations see the same data and perform the same work
  - Preserve timing and concurrency characteristics
  - Same number of user connections
- Replay Client
  - Multithreaded OCI Client
  - Drives multiple captured processes
  - Scalable Architecture
  - Interprets capture into sequence of OCI calls
  - Functional replay



Step 4: Analysis & Reporting

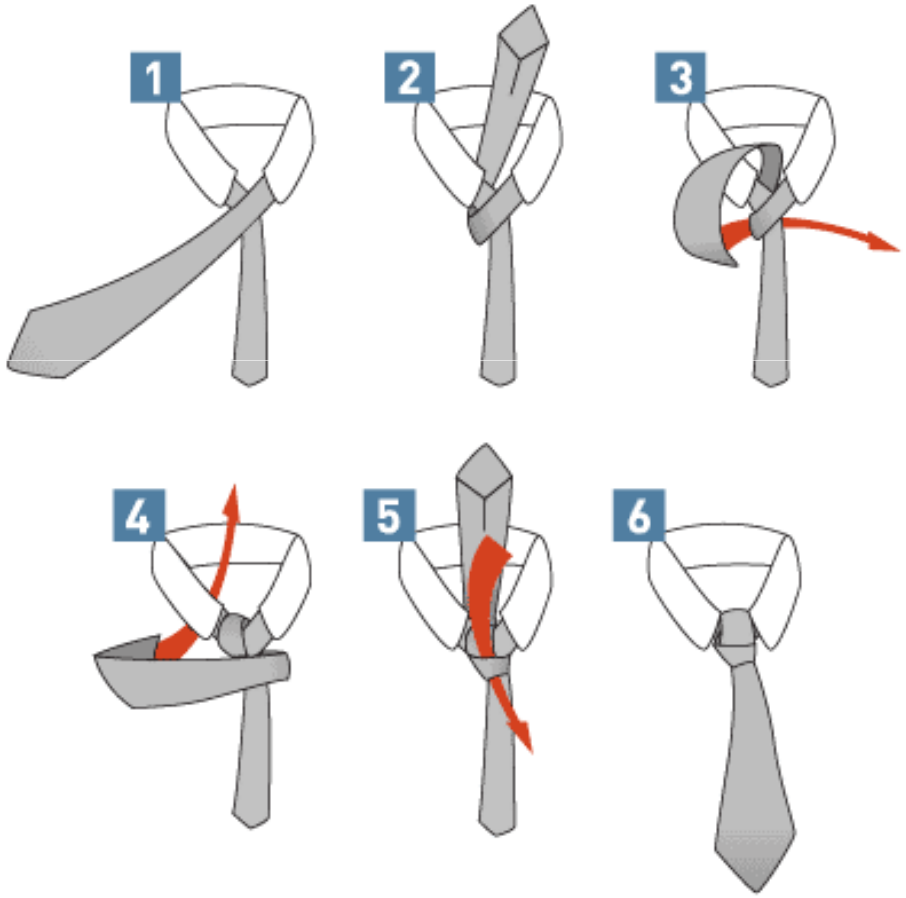
- Error Divergence: For each call error divergence is reported
  - New: Error encountered during replay not seen during capture
  - Not Found: Error encountered during capture not seen during replay
  - Mutated: Different error produced in replay than during capture
- Data Divergence
  - *Replay*: Number of rows returned by each call are compared and divergences reported
  - *User*: Application level validation scripts
- Performance Reporting
  - Capture and Replay Report: Provides high-level performance information
  - ADDM Report: Provides in-depth performance analysis
  - AWR, ASH Report: Facilitates comparative or skew analysis

Current Restrictions

- Database Replay does not support the following features in the current release
  - SQL Loader direct path load, import/export
  - OCI based object navigation (ADTs) and REF binds
  - Non-PL/SQL based AQ
  - Distributed transactions, remote describe/commit operations
  - Flashback queries

Database Replay

- Step-By-Step



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Database Replay

1. Create a copy of the database to replay the workload
   - RMAN Duplicate
   - Snapshot Standby
     - Possibly create a guaranteed restore point

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Database Replay

2. Some guidelines for Workload Capture
   - Ideally restart prod database
     - Why? All transactions can be closed correctly
   - RAC: Just one instance up and running, then start Capture and now start the other instances
   - Start Capture before users logon to the database
     - Therefore start database in **`RESTRICTED`** mode
     - As soon as Capture begins it will switch to **`UNRESTRICTED`**

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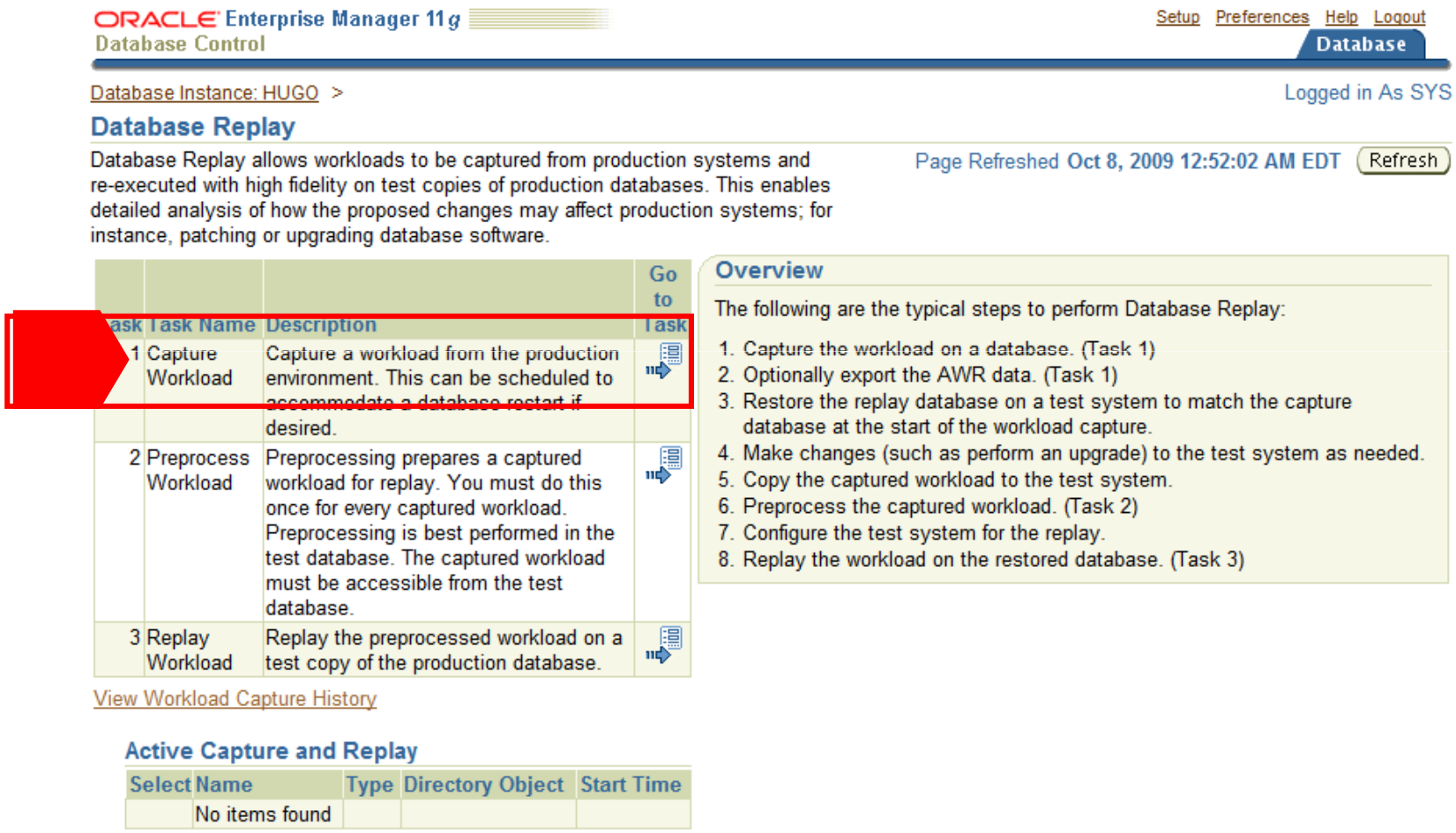
Database Replay

2. Workflow in EM: Workload Capture



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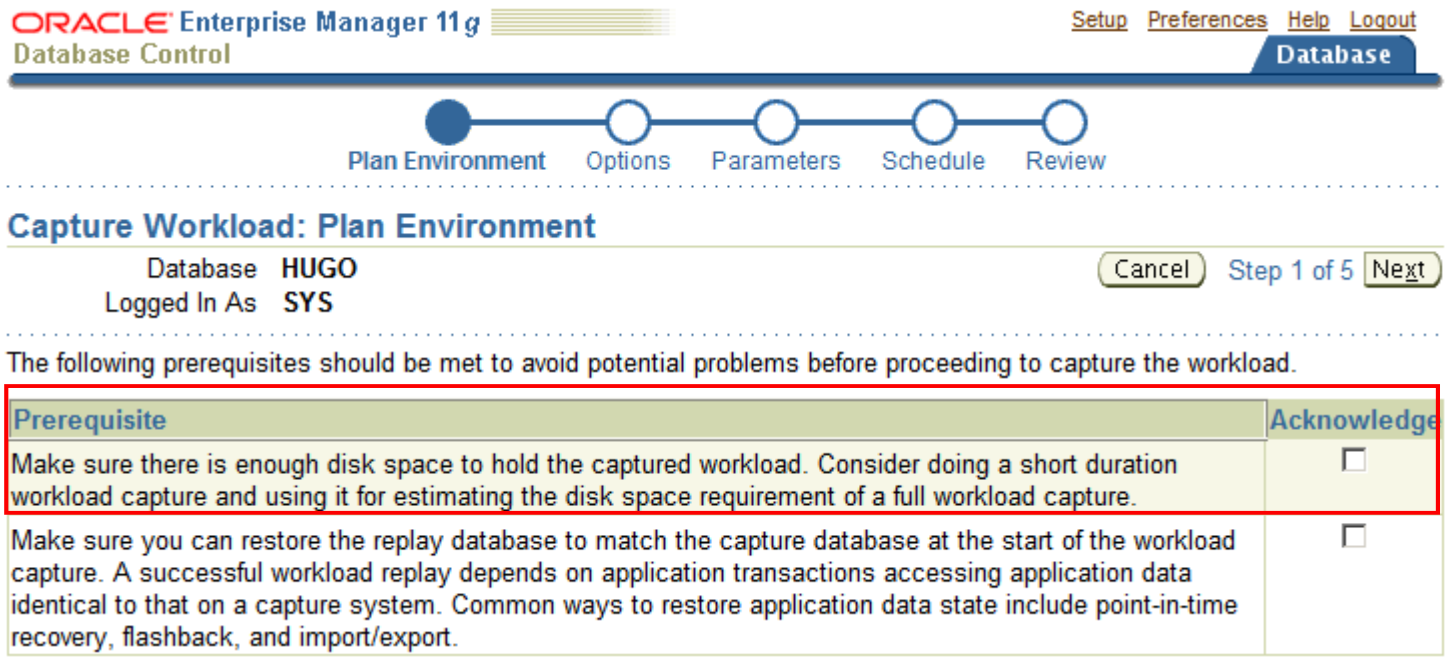
Database Replay

2. Preparation steps in EM: Workload Capture



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Database Replay

3. Define Workload Filter:
   - Default:
     All user sessions will be recorded
   - Inclusion filter:
     Only specified user session will be recorded
   - Exclusion filter:
     All but specified user sessions will be recorded
     - For instance exclude "OMS" and "emagent%"
   - Both filters can't be combined
   - Package:

```
DBMS_WORKLOAD_CAPTURE.ADD_FILTER(fname=>'myFilter',
                                 fattribute=>'USER',
                                fvalue=>'SCOTT');

DBMS_WORKLOAD_CAPTURE.DELETE_FILTER(fname=>'myFilter');
```

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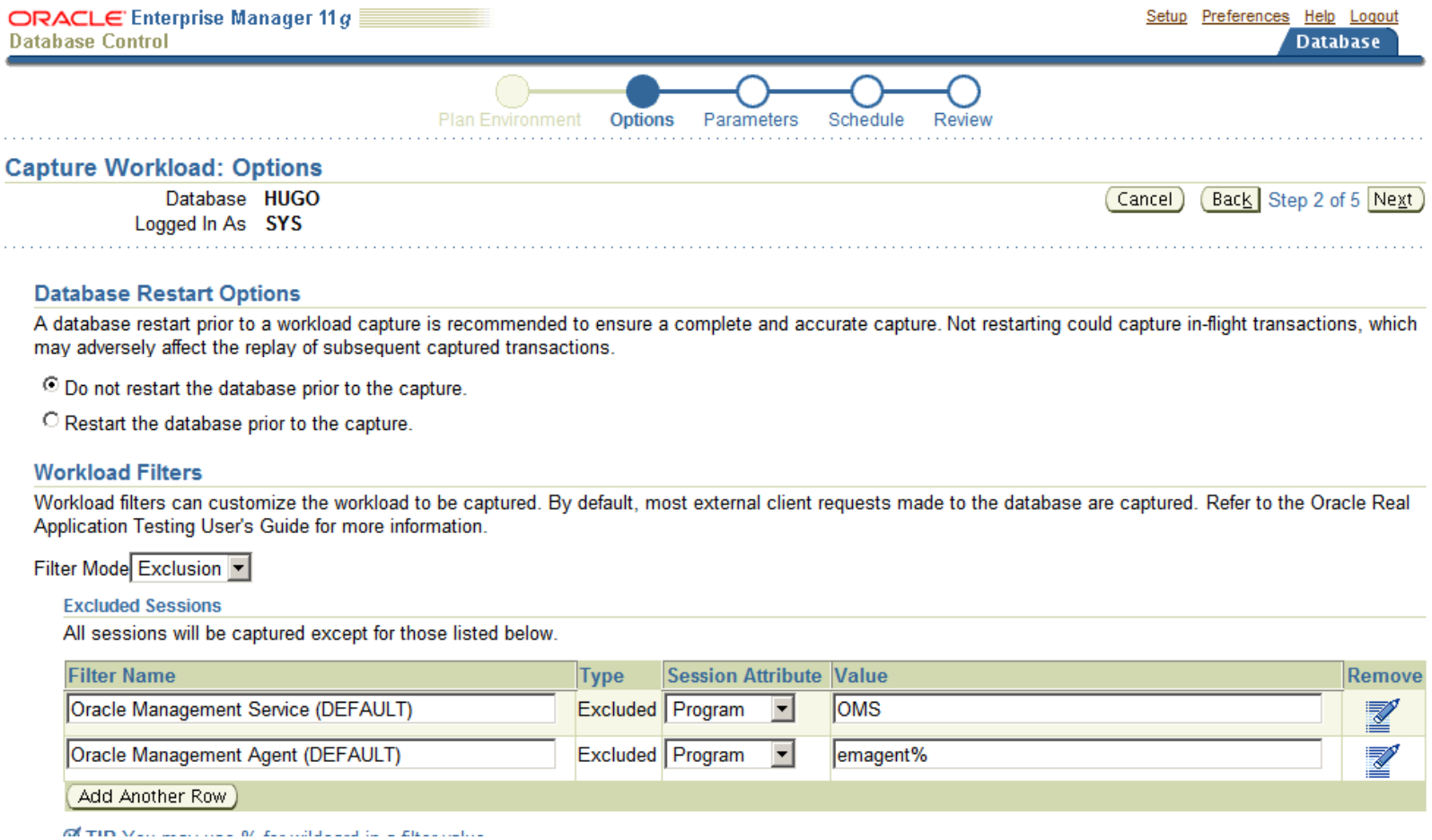
Database Replay

3. Define Workload Filter in EM:



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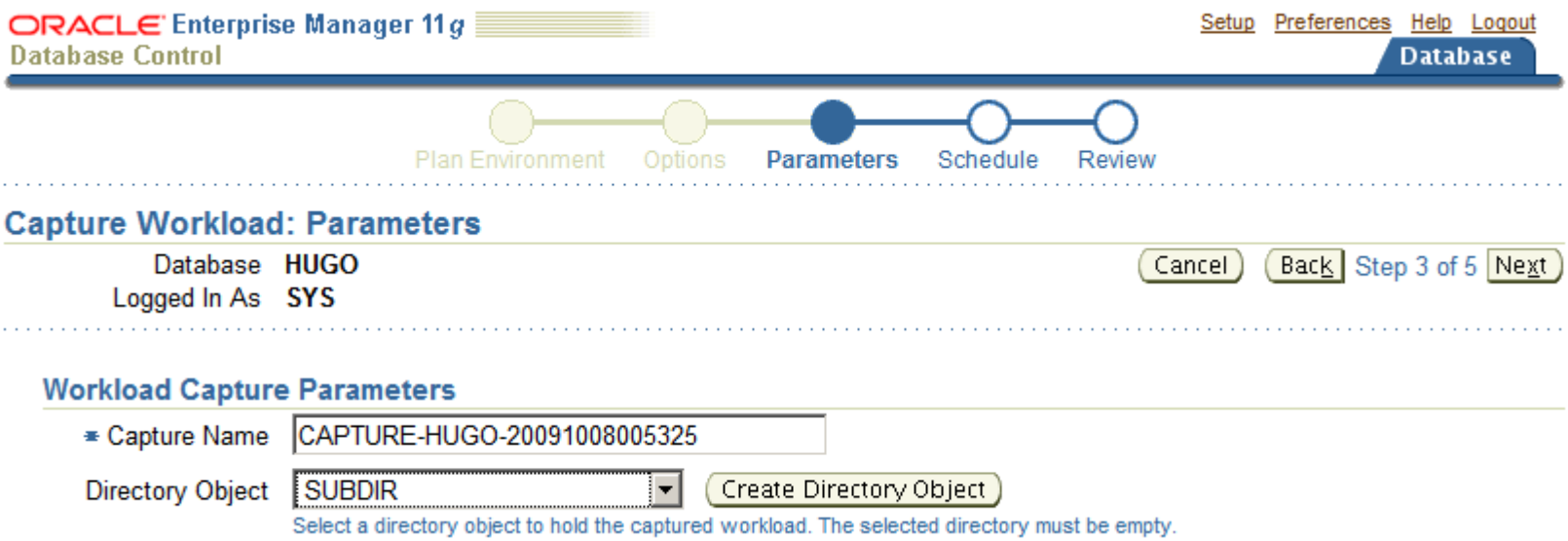
Database Replay

4. Define the capture name:



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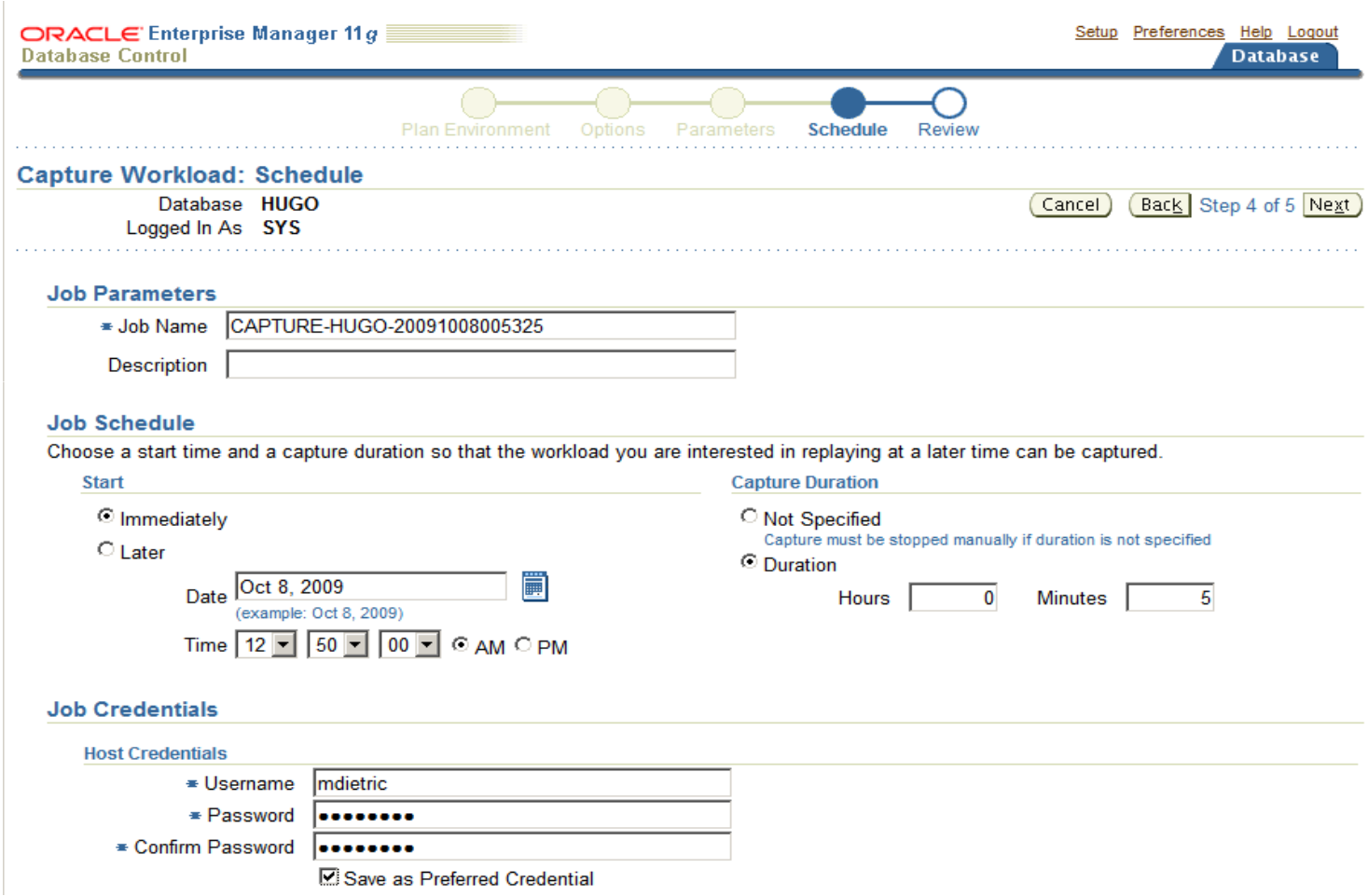
Database Replay

4. Schedule the capture run:



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Database Replay

4. Schedule the capture run:

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Database Replay

4. Start Capture in line mode:

```
BEGIN
   DBMS_WORKLOAD_CAPTURE.START_CAPTURE
  (name => 'hammerora_single_01',
   dir => 'TESTING',
   default_action => 'EXCLUDE');
END;
/
```

5. Stop Capture:

```
BEGIN
   DBMS_WORKLOAD_CAPTURE.FINISH_CAPTURE();
END;
/
```

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Database Replay

- Database Control - capture statistics:

Workload Profile | Workload Filters

View Workload Capture Report

Average Active Sessions

Comparison

	Total	Capture	Percentage of Total
Database Time (hh:mm:ss)	00:11:19	00:07:59	70.54
Average Active Sessions	1.13	0.80	70.54
User Calls	109,251	102,625	93.94
Transactions	289	54	18.69
Connects	37	12	32.43
Application Errors	N/A	51,100	N/A

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Database Replay

- Export AWR in line mode:
  - ```
    BEGIN
       DBMS_WORKLOAD_CAPTURE.EXPORT_AWR
      (capture_id => 5);
    END;
    /
    ```

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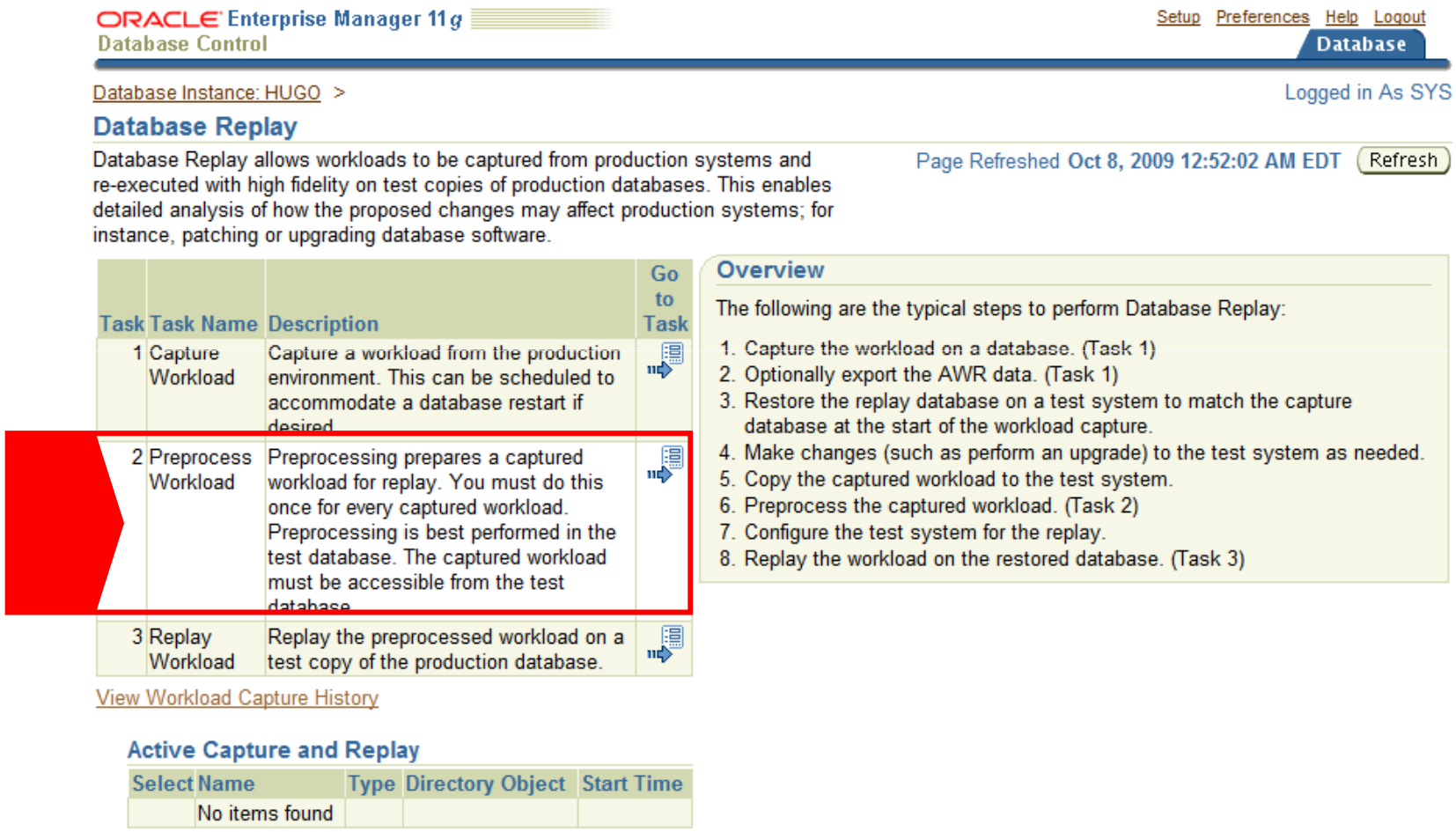
    ```

Database Replay

- Preprocessing captured workload:



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Database Replay

- Preprocessing in line mode:
  - ```
    BEGIN
     DBMS_WORKLOAD_REPLAY.PROCESS_CAPTURE
    (capture_dir => 'TESTING');
    END;
    /
    ```
- Restore database from backup

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    ```

Database Replay

- Import AWR snap
  -

```
DECLARE db_id number;
BEGIN
 db_id := DBMS_WORKLOAD_CAPTURE.IMPORT_AWR
(capture_id => 5, staging_schema => 'TPCC');
END;
/
```

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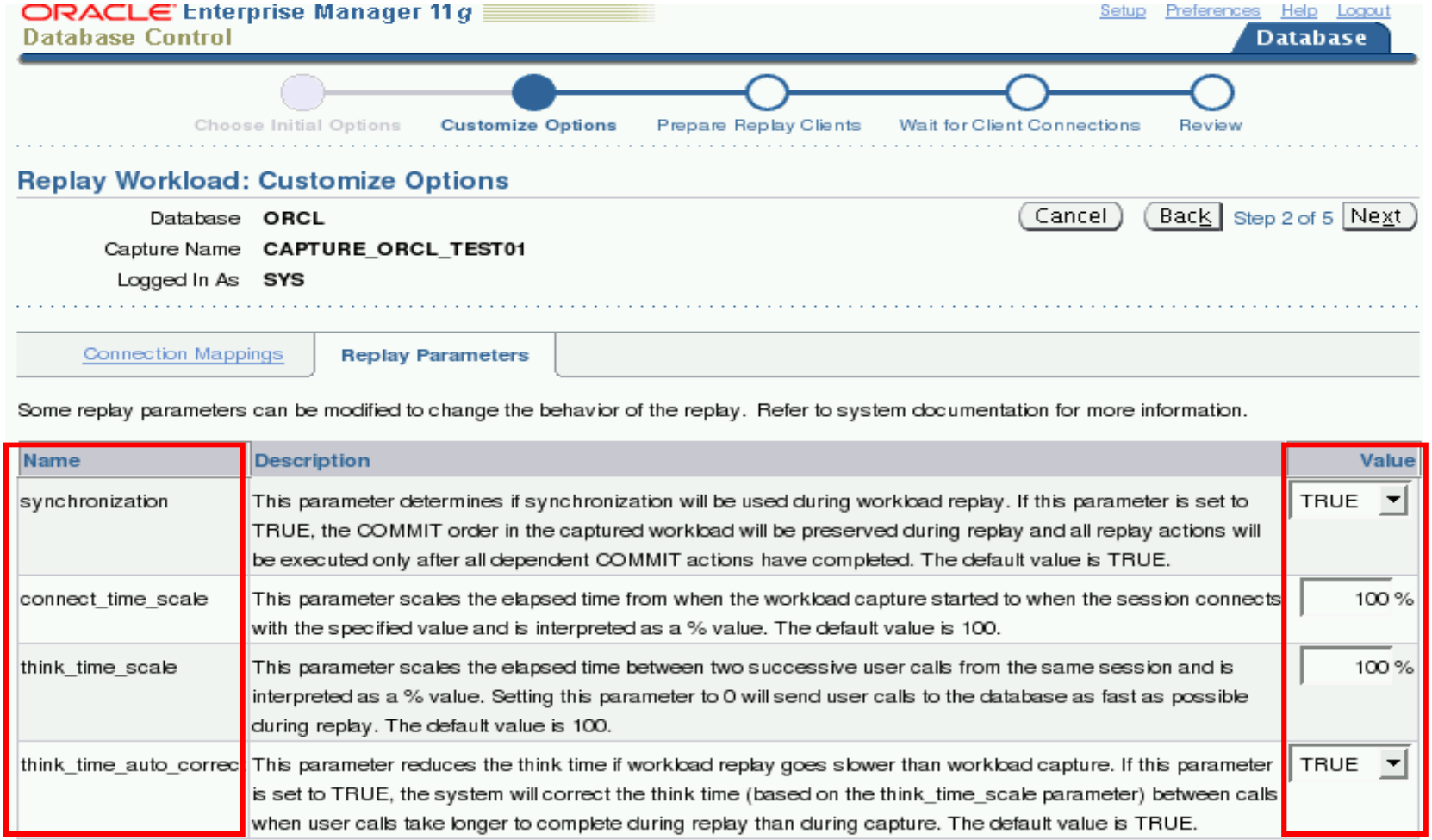
Database Replay

- Workload Replay: replay parameters



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Database Replay

- Initialize and parameterize workload replay clients (wrc):
  -

```
BEGIN

 DBMS_WORKLOAD_REPLAY.INITIALIZE_REPLAY
(replay_name => 'play_hammerora_01',
 replay_dir => 'TESTING');

DBMS_WORKLOAD_REPLAY.PREPARE_REPLAY
(synchronization => TRUE);

END;
/
```

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Database Replay

- Workload Replay Clients: Calibrate
  - **$> wrc mode=calibrate replaydir=/tmp/testing**
- Workload Replay Clients: Start
  - **$> wrc system/oracle mode=replay**

```
$ wrc system/oracle@orcl mode=replay

Workload Replay Client: Release 11.2.0.1.0 - Production on Thu Oct 8 01:21:55 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All rights reserved.


Wait for the replay to start (09:02:10)
```

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Database Replay

- Start Workload Replay in command line mode:
  - ```
    BEGIN
     DBMS_WORKLOAD_REPLAY.START_REPLAY ();
    END;
    /
    ```

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    ```

Database Replay

- Monitor divergence stats:

Divergence

	Number of Calls	Percentage of Total Calls
Error Divergence:		
Session Failures Seen During Replay	0	0.00
Errors No Longer Seen During Replay	0	0.00
Errors Mutated During Replay	0	0.00
New Errors Seen During Replay	0	0.00
Data Divergence:		
DMLs with Different Number of Rows Modified	0	0.00
SELECTs with Different Number of Rows Fetched	0	0.00

Detailed Comparison

	Capture	Replay	Percentage of Capture
Duration (hh:mm:ss)	00:10:25	00:10:00	96.00
Database Time (hh:mm:ss)	00:17:06	00:15:22	89.86
Average Active Sessions	1.64	1.54	93.61
User Calls	18,141	18,133	99.96

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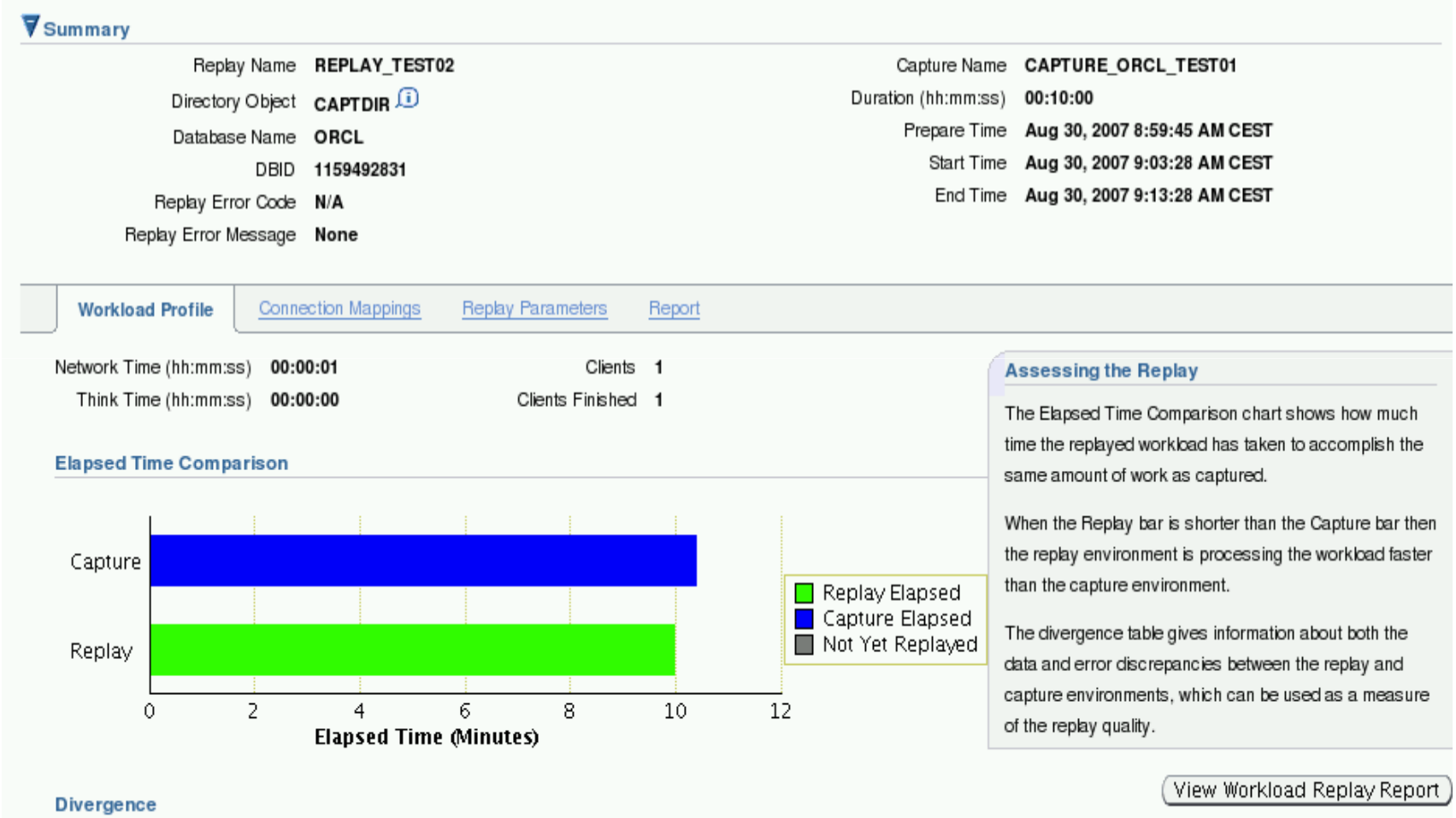
Database Replay

- Workload Replay result:



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Database Replay

- Workload replay reporting in CLI:
  -

```
DECLARE
  cap_id          NUMBER;
  rep_id          NUMBER;
  rep_rpt         CLOB;
BEGIN
  cap_id := DBMS_WORKLOAD_REPLAY.GET_REPLAY_INFO
            (dir => 'TESTING');

 /* Get the latest replay for that capture */
  SELECT max(id) INTO rep_id
  FROM   dba_workload_replays WHERE capture_id=cap_id;

  rep_rpt := DBMS_WORKLOAD_REPLAY.REPORT
             (replay_id => rep_id,
             format => DBMS_WORKLOAD_REPLAY.TYPE_TEXT);
END;
/
```

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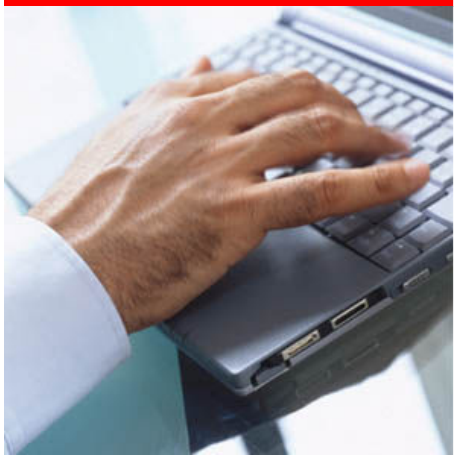
Agenda



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- News and Task List
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  - Challenges
  - SQL Plan Management
  - Database Replay
  - SQL Performance Analyzer
- Best Practices

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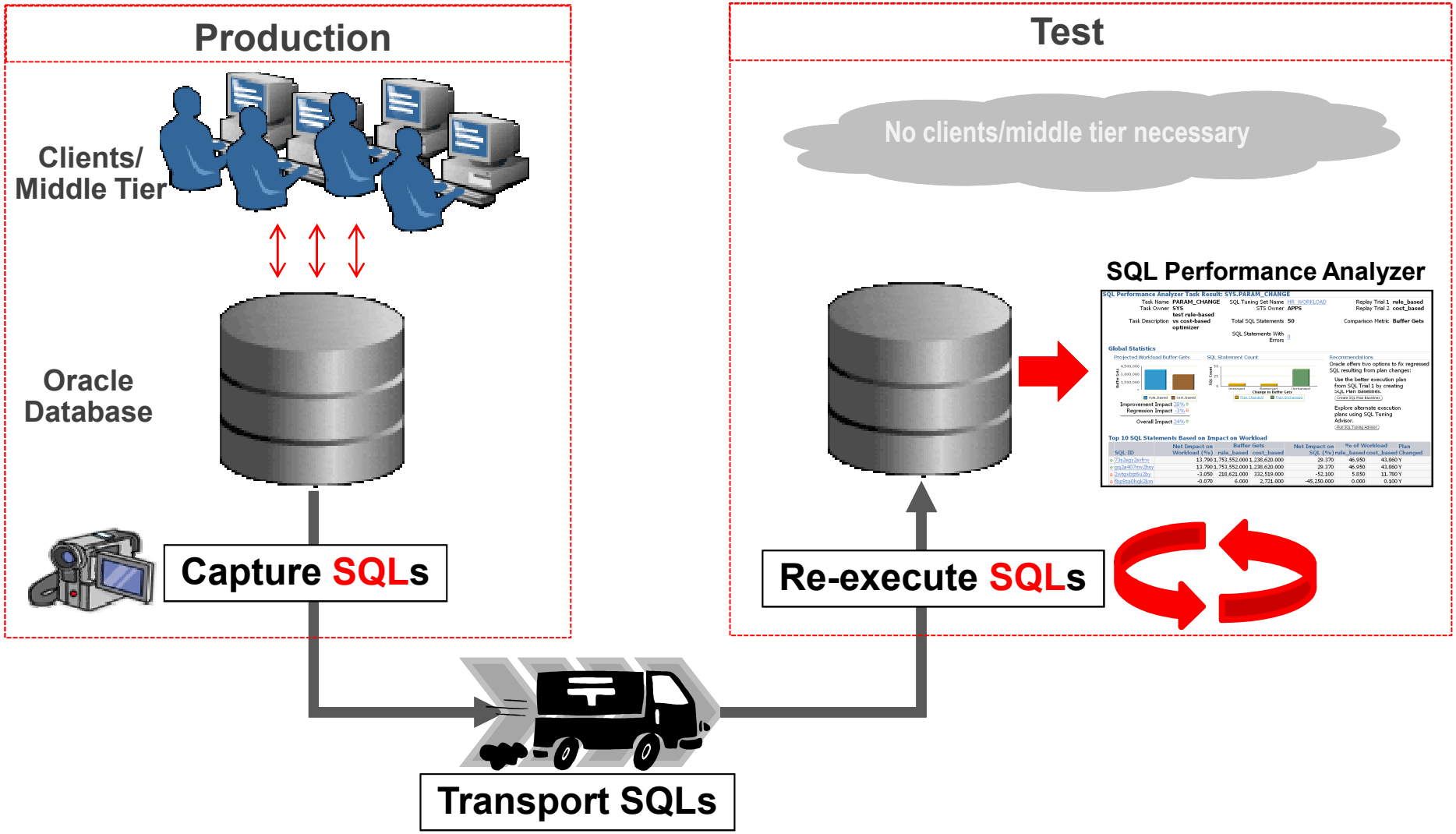
SQL Performance Analyzer: Overview



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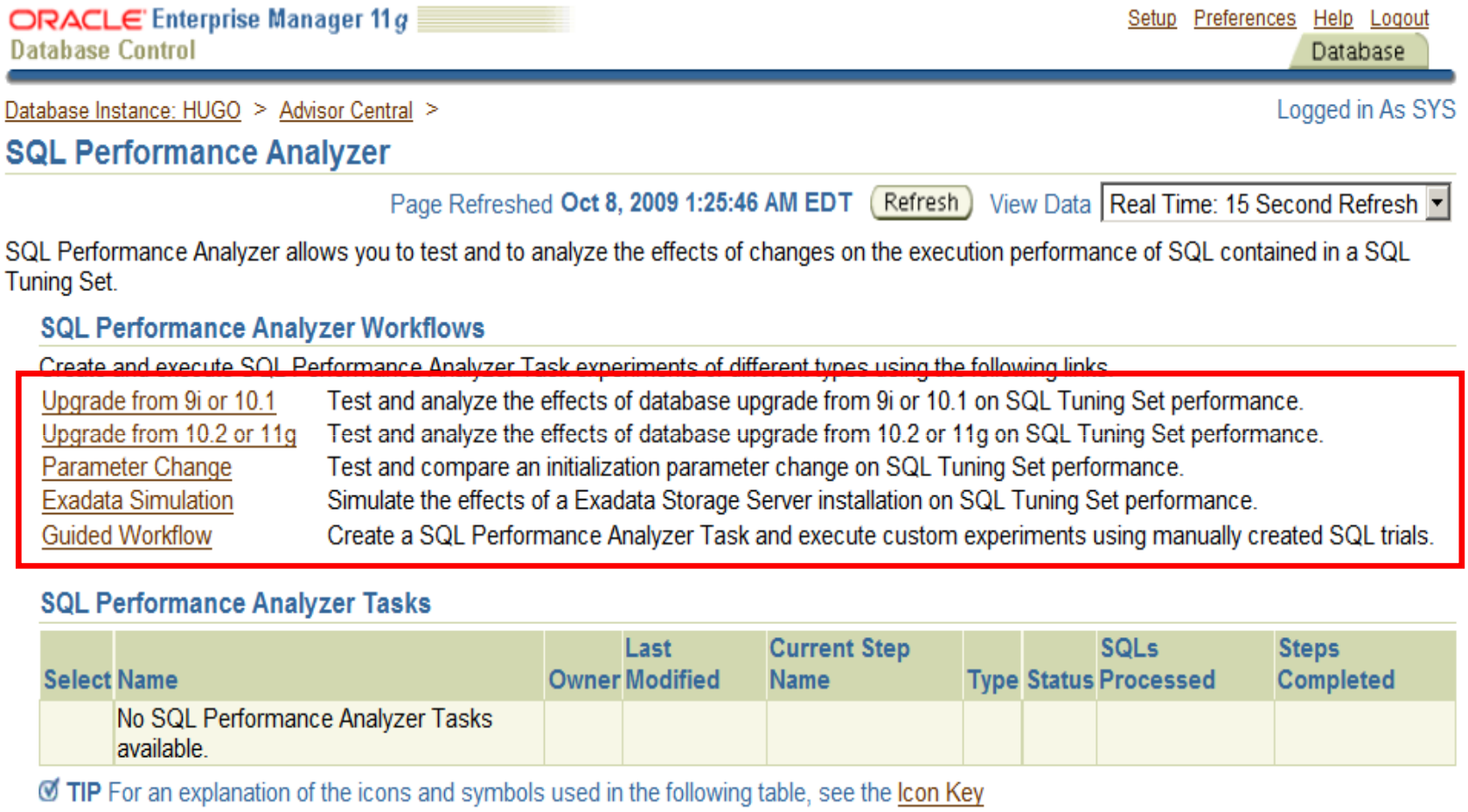
SPA in Enterprise Manager



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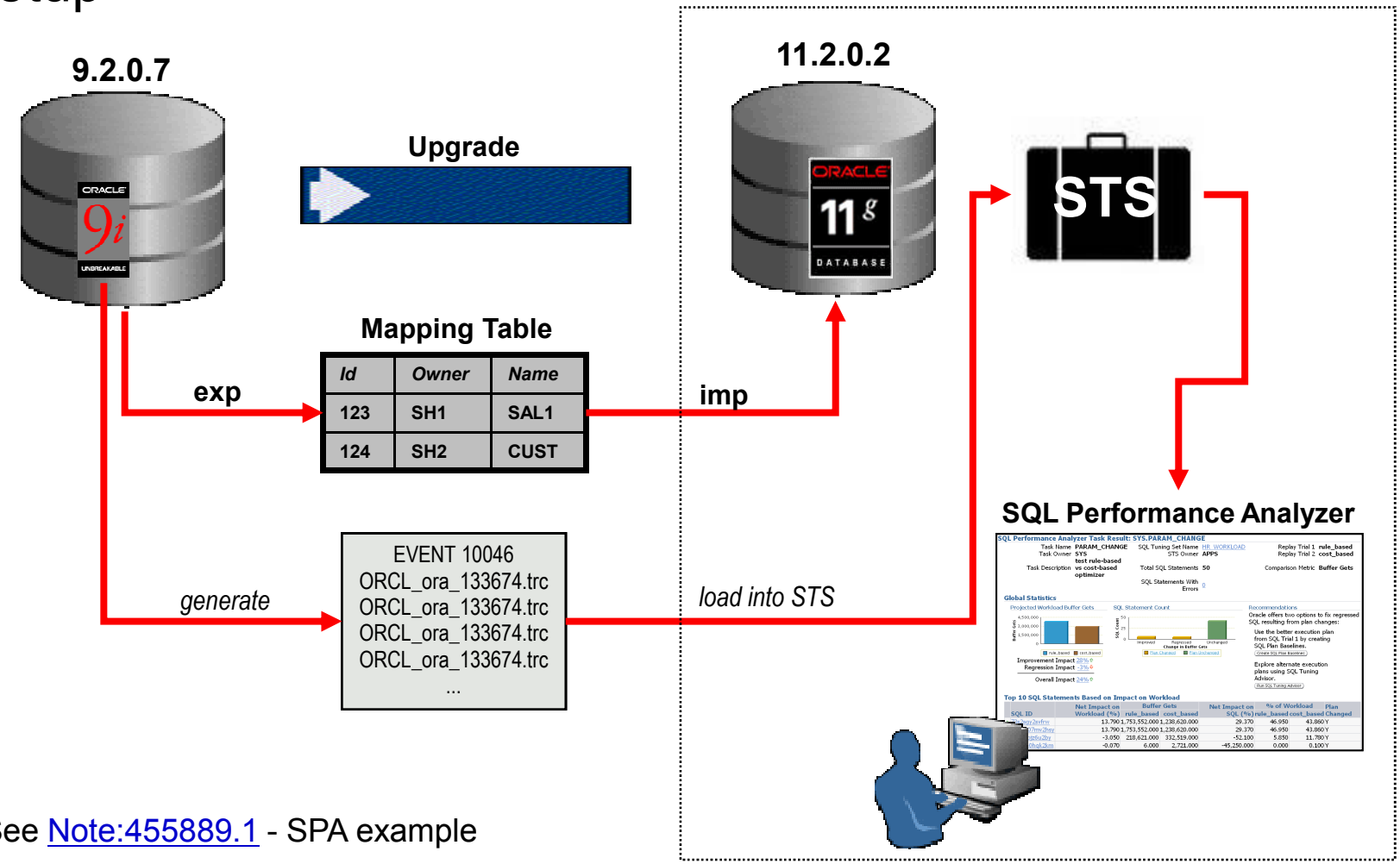
SPA with a 9*i* workload

- Setup



See Note:455889.1 - SPA example

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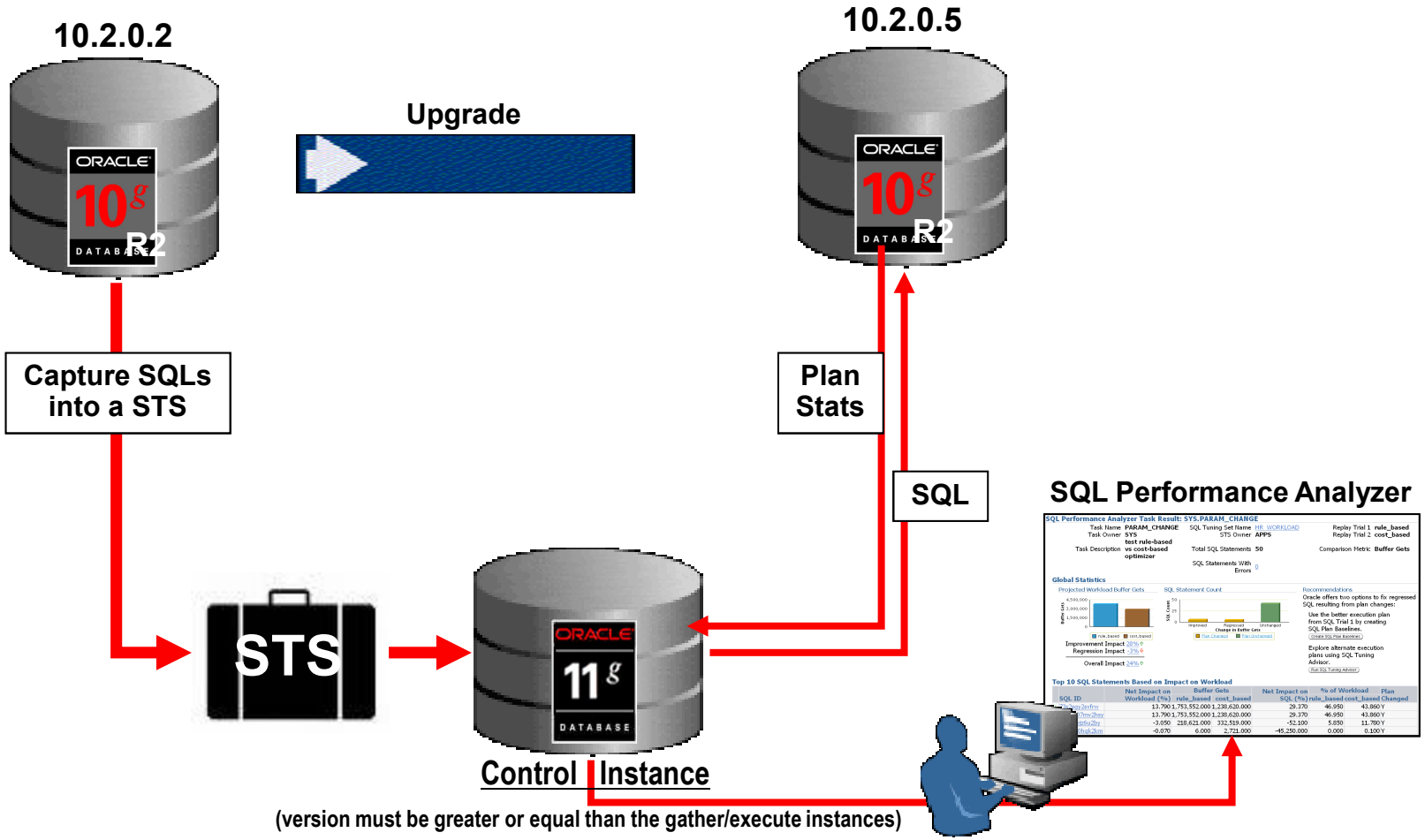
SPA for patch upgrades: 10.2.0.2 => 10.2.0.5

- Setup



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SPA for a 9*i* workload against 11*g*

- Enable statistics timing:
  - `alter system set timed_statistics=true;`
- Enable tracing on 9*i*:
  -
```
alter system set events
         '10046 trace name context forever, level 4';
```

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SPA for a 9*i* workload against 11*g*

- Create the mapping table in 9*i*:
  - ```
    create table MAPPING_TABLE as
    select object_id id, owner, substr(object_name, 1, 30) name
    from dba_objects
    where object_type NOT IN ('CONSUMER GROUP', 'EVALUATION
    CONTEXT', 'FUNCTION', 'INDEXTYPE', 'JAVA CLASS', 'JAVA
    DATA', 'JAVA RESOURCE', 'LIBRARY', 'LOB', 'OPERATOR',
    'PACKAGE', 'PACKAGE BODY', 'PROCEDURE', 'QUEUE', 'RESOURCE
    PLAN', 'SYNONYM', 'TRIGGER', 'TYPE', 'TYPE BODY',)
    union all select user_id id, username owner, null name
    from dba_users;
    ```

- Disable tracing in 9*i* afterwards:
  - ```
    alter system set events '10046 trace name context forever off';
    ```

- Export mapping table with `exp`

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SPA for a 9*i* workload against 11*g*

- Create a directory object in 11*g*:
  - `create or replace DIRECTORY 'SPA_DIR' as '/tmp/spa';`
- Use 11.1.0.7 or above
  - See Note:562899.1
    Testing SQL performance impact of an Oracle 9i to Oracle Database 10gR2 upgrade with SPA
- Transport *event 10046 trace files* to the 11*g* system
- Import mapping table

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SPA for a 9*i* workload against 11*g*

- Create a SQL Tuning Set (STS) in 11*g*:
  -
```
declare
  mycur      DBMS_SQLTUNE.SQLSET_CURSOR;
begin
  DBMS_SQLTUNE.CREATE_SQLSET('SPA_9iWKLD');
  open mycur for
    select value(p) from
      table(DBMS_SQLTUNE.SELECT_SQL_TRACE(
            directory => 'SPA_DIR',
            file_name => '%ora%',
            mapping_table_name => 'MAPPING_TABLE',
            select_mode => DBMS_SQLTUNE.SINGLE_EXECUTION)) p;
    DBMS_SQLTUNE.LOAD_SQLSET('SPA_9iWKLD', mycur);
  close mycur;
end;
/
```
  - Monitor progress in `DBA_SQLSET`

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SPA for a 9*i* workload against 11*g*

- Create a SPA task in 11*g*:
  - ```
    var tname varchar2(200);

    execute
      :tname := DBMS_SQLPA.CREATE_ANALYSIS_TASK(
        sqlset_name => 'SPA_9iWKLD',
        task_name   => 'SPA_TASK_9i_11g',
        description => 'Test 9i to 11g upgrade');

    print tname
    ```

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    ```

SPA for a 9*i* workload against 11*g*

- Parameterize the SPA task
  - ```
    begin
      DBMS_SQLPA.SET_ANALYSIS_TASK_PARAMETER(
        task_name => 'SPA_TASK_9i_11g',
        parameter => 'WORKLOAD_IMPACT_THRESHOLD',
        value => 0);
      DBMS_SQLPA.SET_ANALYSIS_TASK_PARAMETER(
        task_name => 'SPA_TASK_9i_11g',
        parameter => 'SQL_IMPACT_THRESHOLD',
        value => 5);
    end;
    /
    ```
  - To filter "noise" use "SQL_IMPACT_THRESHOLD"=5 (means only regressed SQL 5% above this threshold will be shown)

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    ```

SPA for a 9*i* workload against 11*g*

- Establish "Before Change" trial (from collected 9*i* info)

```
begin
  DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name      => 'SPA_TASK_9i_11g',
    execution_name => 'SPA_RUN1_9i',
    execution_type => 'CONVERT SQLSET',
    execution_desc => '9i run generated from STS');
end;
/
```

- Run 11*g* execution

```
begin
  DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name      => 'SPA_TASK_9i_11g',
    execution_name => 'SPA_RUN2_11g',
    execution_type => 'TEST EXECUTE',
    execution_desc => 'Test now against 11g');
end;
/
```

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SPA for a 9*i* workload against 11*g*

- Compare results
  - ```
    execute
      DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
        task_name        => 'SPA_TASK_9i_11g',
        execution_name   => 'COMPARE_9i_11g_CPU',
        execution_type   => 'COMPARE PERFORMANCE',
        execution_params => DBMS_ADVISOR.ARGLIST(
                              'COMPARISON_METRIC', 'CPU_TIME',
                              'EXECUTION_NAME1', 'SPA_RUN1_9i',
                              'EXECUTION_NAME2', 'SPA_RUN2_11g'),
        execution_desc   => 'Compare 9i vs. 11g on CPU_TIME');
    ```
  - Comparison metrics options:
    - **CPU_TIME**
    - **BUFFER_GETS**

      } Compare performance for at least these two metric
    - PARSE_TIME
    - ELAPSED_TIME
    - USER_IO_TIME
    - DISK_READS
    - DIRECT_WRITES
    - OPTIMIZER_COST

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    ```

SPA for a 9*i* workload against 11*g*

- Generate summary report
  -

```
set heading off
set long 1000000000
set longchunksize 10000
set echo off;
set linesize 1000;

spool /tmp/spa_9i_11g_cpu_summary.html

select
  xmltype(DBMS_SQLPA.REPORT_ANALYSIS_TASK(
   'SPA_TASK_9i_11g',      /* task_name */
   'html',                 /* type */
   'typical',              /* level */
   'summary',              /* section */
   null,                   /* object_id */
   100,                    /* top_sql */
   'COMPARE_9i_11g_CPU')).getclobval(2,2) /* execution_name */
from dual;

spool off
```

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SPA for a 9*i* workload against 11*g*

- Generate regressed SQL report
  -
```
set heading off
set long 1000000000
set longchunksize 10000
set echo off;
set linesize 1000;

spool /tmp/spa_9i_11g_cpu_regressed.html

select
  xmltype(DBMS_SQLPA.REPORT_ANALYSIS_TASK(
   'SPA_TASK_9i_11g',                          /* task_name */
   'html',                                     /* type */
   'regressed',                                /* level */
   'all',                                      /* section */
   null,                                       /* object_id */
   null,                                       /* top_sql */
   'COMPARE_9i_11g_CPU')).getclobval(2,2) /* execution_name */
from dual;

spool off
```


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SPA for a 9*i* workload against 11*g*

- Generate changed plans report
  -

```
set heading off
set long 1000000000
set longchunksize 10000
set echo off;
set linesize 1000;

spool /tmp/spa_9i_11g_changed_plans.html

select
  xmltype(DBMS_SQLPA.REPORT_ANALYSIS_TASK(
   'SPA_TASK_9i_11g',                          /* task_name */
   'html',                                     /* type */
   'changed_plans',                            /* level */
   'all',                                      /* section */
   null,                                       /* object_id */
   null,                                       /* top_sql */
   'COMPARE_9i_11g_CPU')).getclobval(2,2) /* execution_name */
from dual;

spool off
```

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Real World Experience: SPA

- Regressed report in detail:

Report Summary

Projected Workload Change Impact:

Overall Impact : 0%
Improvement Impact : 0%
Regression Impact : 0%

SQL Statement Count

SQL Category	SQL Count	Plan Change Count
Overall	3552	1593
Improved	658	410
Regressed	99	45
Unchanged	1756	1138

SQL Statements Sorted by their Absolute Value of Change Impact on the Workload

object_id	sql_id	Impact on Workload	Metric Before	Metric After	Impact on SQL	% Workload Before	% Workload After	Plan Change
7277	a304c09qqxxf3	-,4%	20	220	-1000%	,04%	1,3%	y
8144	f26jufdtjj0zm	-,26%	20	150	-650%	,04%	,89%	y
7283	a4vrsq0j6y2fc	-,22%	360	470	-30,56%	,73%	2,78%	y
7121	acnhk0m3z1u8x	-,2%	520	620	-19,23%	1,05%	3,66%	n
10654	99nvqcudjk24p	-,16%	40	120	-200%	,08%	,71%	y
10370	8154ppykrdwjp	-,1%	100	150	-50%	,2%	,89%	y
7432	bssxzb5u2r4s8	-,04%	10	30	-200%	,02%	,18%	n
8191	f7urp05wu65qc	-,04%	10	30	-200%	,02%	,18%	n
10076	7q35p71hppfwc	-,04%	70	90	-28,57%	,14%	,53%	y
7122	acp131yy307d6	-,02%	0	10	-1000%	0%	,06%	n
7125	adc1mqhj6vq2k	-,02%	0	10	-1000%	0%	,06%	y
7246	a0c4hh6yqm0k1	-,02%	0	10	-1000%	0%	,06%	n
7318	a9nrj45s4c0bk	-,02%	0	10	-1000%	0%	,06%	n
7321	baqpudrqswspw	-,02%	0	10	-1000%	0%	,06%	y

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Real World Experience: SPA

- Regressed report in detail:

Report Details: Statements Sorted by their Absolute Value of Change Impact on the Workload

SQL Details:

Object ID : 7277
Schema Name : UHRZS006
SQL ID : a304c09gqxxf3
Execution Frequency : 1
SQL Text : select a,b,c from (select ware a,kommentar b, p.nachname c from BUCHUNGEN b, PERSON p where zeit > '20080710000000' and eid = 349905 and kommentar like 'show_user%' and b.ware = p.id and p.status != 'l' order by zeit desc) where rownum < 60

Stat Name	Impact on Workload	Value Before	Value After	Impact on SQL	% Workload Before	% Workload After
elapsed_time	-1,61%	,022	1,206	-5381,82%	,03%	4,08%
parse_time			,001			,02%
cpu_time	-,4%	,02	,22	-1000%	,04%	1,3%
buffer_gets	-,01%	1721	1802	-4,71%	,2%	,28%
cost			7			0%
reads	-20,66%	0	2215	-221500%	0%	7,09%
writes	0%	0	0	0%	0%	0%
rows		36	33			

Findings (3):

1. Die Performance dieser SQL-Anweisung wurde vermindert.
2. Die Struktur des SQL-Ausfuhrungsplans wurde geandert.
3. Die Anzahl von zuruckgegebenen Zeilen in Ausfuhrung 'CONV_SPA_TASK_KLAUS' unterscheidet sich von Ausfuhrung 'EXEC_SPA_TASK_KLAUS'.

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Real World Experience: SPA

- Regressed report in detail:

Execution Plan Before Change:

Plan Hash Value : Unknown

Id	Operation	Name	Rows	Bytes	Cost	Time
0	SELECT STATEMENT					
1	COUNT STOPKEY					
2	VIEW					
3	SORT ORDER BY STOPKEY					
4	NESTED LOOPS					
5	TABLE ACCESS BY INDEX ROWID	BUCHUNGEN				
6	INDEX RANGE SCAN	I_EID_BUCHUNGEN				
7	TABLE ACCESS BY INDEX ROWID	PERSON				
8	INDEX UNIQUE SCAN	SYS_C0010236				

Empty because source db was an Oracle 9*i* database

Execution Plan After Change:

Plan Id : 27959
Plan Hash Value : 4020578872

Id	Operation	Name	Rows	Bytes	Cost	Time
0	SELECT STATEMENT		1	2154	7	00:00:01
* 1	COUNT STOPKEY					
2	VIEW		1	2154	7	00:00:01
* 3	SORT ORDER BY STOPKEY		1	220	7	00:00:01
4	NESTED LOOPS					
5	NESTED LOOPS		1	220	6	00:00:01
* 6	TABLE ACCESS BY INDEX ROWID	BUCHUNGEN	1	201	5	00:00:01
* 7	INDEX RANGE SCAN	I_EID_BUCHUNGEN	52		1	00:00:01
* 8	INDEX UNIQUE SCAN	SYS_C0012673	1		1	00:00:01
* 9	TABLE ACCESS BY INDEX ROWID	PERSON	1	19	1	00:00:01

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SPA for a 9*i* workload against 11*g*

- Compare results
  - Be cautious in interpreting trial results
  - Environmental traps:
    - SPA is agnostic of the environment used for pre- and post-change trials
  - Data changes during SQL tracing
  - Bias caused by SQL tracing in 9*i*
  - Reports may be overly optimistic or pessimistic due to above reasons

  - Recommended approach is to investigate as follows:
    - Summary of change impact by `CPU_TIME` and `BUFFER_GETS`
    - Detailled regressed SQL based on `CPU_TIME` and `BUFFER_GETS`
    - SQL with changed plans

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Capturing a SQL Workload for SPA

- Capture from cursor cache
  - Create a SQL Tuning Set (STS)
    -
```
BEGIN
  DBMS_SQLTUNE.CREATE_SQLSET(
     sqlset_name => 'SPA_STS',
     description => 'Upgrade test STS for SPA');
END;
/
```
  - Capture SQL directly from the cursor cache into STS
    -
```
BEGIN
  DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET(
    sqlset_name     => 'SPA_STS',
    time_limit      => 15*60,
    repeat_interval => 10,
    capture_mode    => dbms_sqltune.MODE_ACCUMULATE_STATS);
END;
/
```

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Capturing a SQL Workload for SPA

- Filter statements from a STS:
  -
```
EXEC
  DBMS_SQLTUNE.DELETE_SQLSET(
    sqlset_name  => 'SPA_STS',
    basic_filter => 'parsing_schema_name=''MDSYS''');
```
    - This will delete all statements belonging to MDSYS from the STS
    - `BASIC_FILTER` will be treated like a `WHERE` clause for this `DELETE` action
- Proceed with creation of a SPA analysis task:
  -
```
EXECUTE
  DBMS_SQLPA.CREATE_ANALYSIS_TASK(
    task_name   => 'SPA_TASK_CURSOR_CACHE',
    description => 'SPA with statements from CC',
    sqlset_name => 'SPA_STS');
```

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Parameter Changes

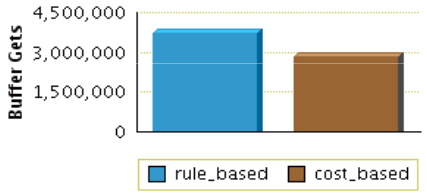
- SPA Recommendation: SQL Tuning Advisor

SQL Performance Analyzer Task Result: SYS.PARAM_CHANGE

Task Name	PARAM_CHANGE	SQL Tuning Set Name	HR_WORKLOAD	Replay Trial 1	rule_based
Task Owner	SYS	STS Owner	APPS	Replay Trial 2	cost_based
Task Description	test rule-based vs cost-based optimizer	Total SQL Statements	50	Comparison Metric	Buffer Gets
		SQL Statements With Errors	0		

Global Statistics

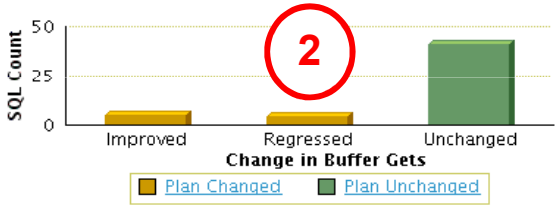
Projected Workload Buffer Gets



Improvement Impact 28%
Regression Impact -3%
Overall Impact 24%

1

SQL Statement Count



2

Recommendations

Oracle offers two options to fix regressed SQL resulting from plan changes:

Use the better execution plan from SQL Trial 1 by creating SQL Plan Baselines.

Create SQL Plan Baselines

Explore alternate execution plans using SQL Tuning Advisor.

Run SQL Tuning Advisor

3

Top 10 SQL Statements Based on Impact on Workload

	SQL ID	Net Impact on Workload (%)	Buffer Gets rule_based	Buffer Gets cost_based	Net Impact on SQL (%)	% of Workload rule_based	% of Workload cost_based	Plan Changed
⇧	73s2sgy2svfrw	13.790	1,753,552.000	1,238,620.000	29.370	46.950	43.860	Y
⇧	gq2a407mv2hsy	13.790	1,753,552.000	1,238,620.000	29.370	46.950	43.860	Y
⇩	2wtgxbjz6u2by	-3.050	218,621.000	332,519.000	-52.100	5.850	11.780	Y
⇩	fbp9za0hqk2km	-0.070	6.000	2,721.000	-45.250.000	0.000	0.100	Y

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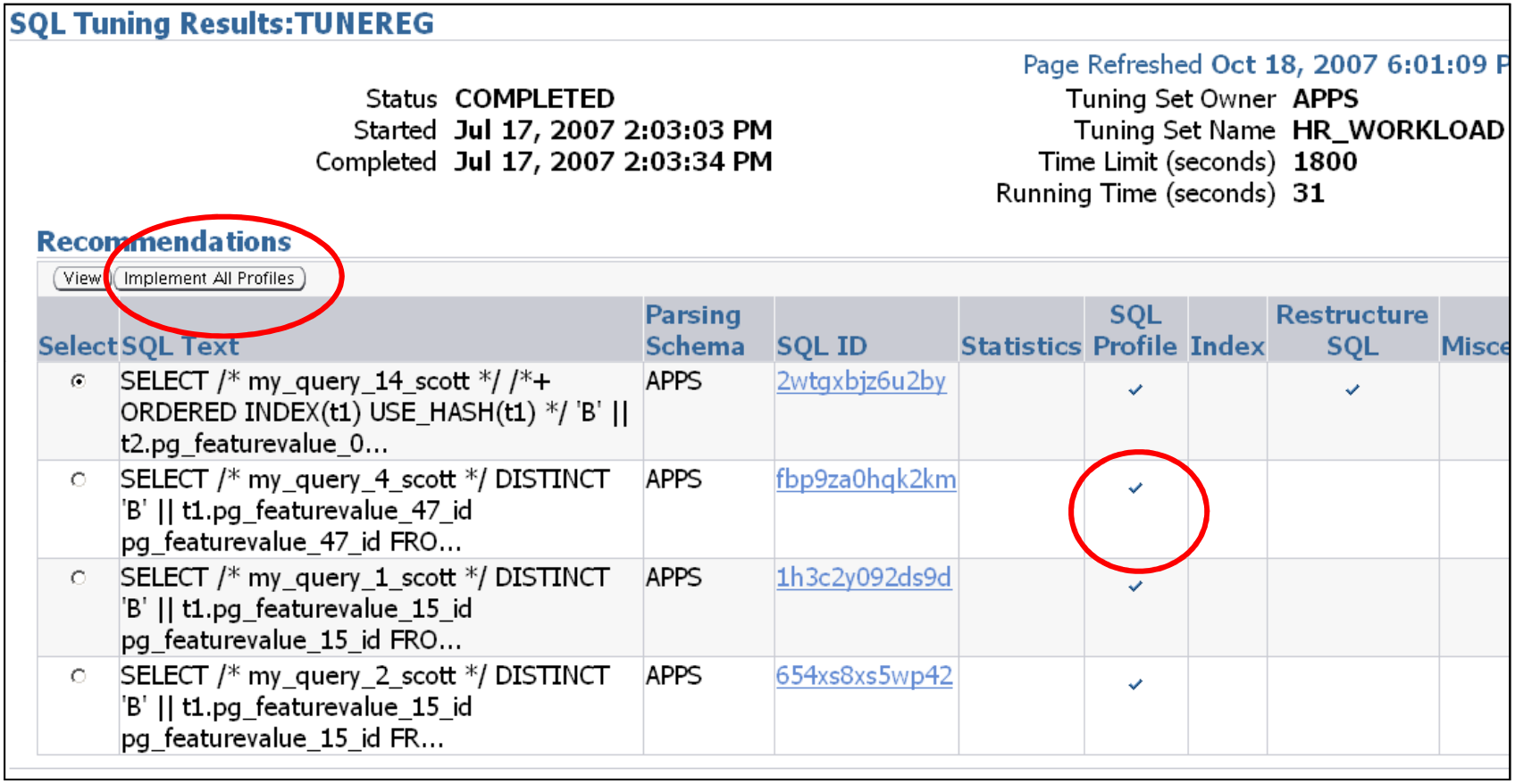
Parameter Changes

- SQL Tuning Advisor offers SQL Profiles



SQL Tuning Results:TUNEREG

Page Refreshed Oct 18, 2007 6:01:09 P

Status COMPLETED
Started Jul 17, 2007 2:03:03 PM
Completed Jul 17, 2007 2:03:34 PM

Tuning Set Owner APPS
Tuning Set Name HR_WORKLOAD
Time Limit (seconds) 1800
Running Time (seconds) 31

Recommendations

View | Implement All Profiles

Select	SQL Text	Parsing Schema	SQL ID	Statistics	SQL Profile	Index	Restructure SQL	Misce
◉	SELECT /* my_query_14_scott */ /*+ ORDERED INDEX(t1) USE_HASH(t1) */ 'B' || t2.pg_featurevalue_0...	APPS	2wtgxbjz6u2by		✓		✓	
○	SELECT /* my_query_4_scott */ DISTINCT 'B' || t1.pg_featurevalue_47_id pg_featurevalue_47_id FRO...	APPS	fbp9za0hqk2km		✓			
○	SELECT /* my_query_1_scott */ DISTINCT 'B' || t1.pg_featurevalue_15_id pg_featurevalue_15_id FRO...	APPS	1h3c2y092ds9d		✓			
○	SELECT /* my_query_2_scott */ DISTINCT 'B' || t1.pg_featurevalue_15_id pg_featurevalue_15_id FR...	APPS	654xs8xs5wp42		✓			

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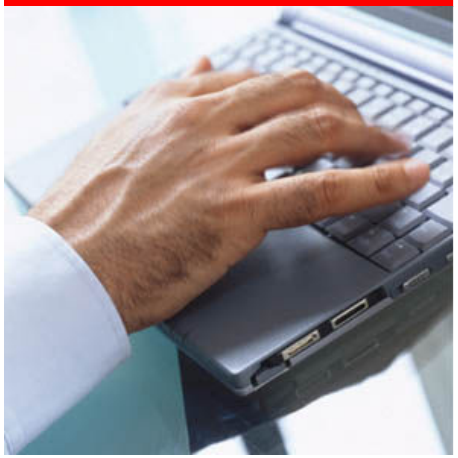
Agenda



- Preparation
- Installation
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- Performance Testing
- Best Practices

Fallback Strategies
Guidelines
Real World Experiences

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Fallback Strategy - Concepts

- Fallback concepts:
  - Always take a complete online backup first!
  - Differentiate between fallback concepts:
    - Are you allowed to lose data in case of a fallback?
    - Deal with problems ...
      - ... encountered during the upgrade
      - ... found days *after* the upgrade
    - Will you get additional downtime to change COMPATIBLE?
    - Fallback requirements in minutes/hours?

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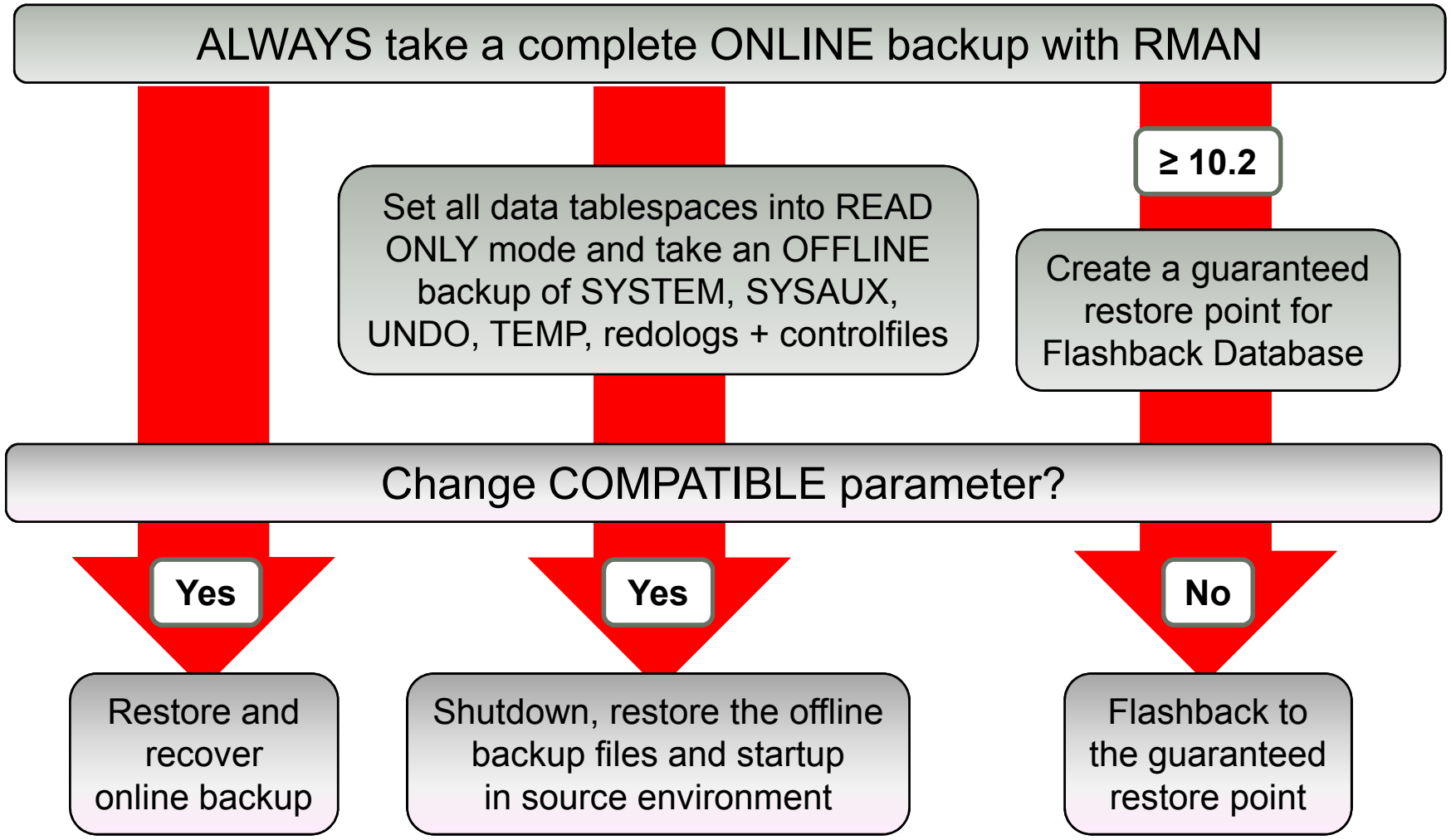
Fallback Strategy - Issues during upgrade



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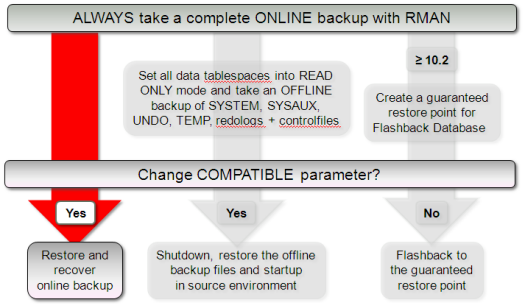
Fallback Strategy

Online Backup



- Restore a backup
  - Complete online backup (RMAN)
  - Please verify:
    - Where is your backup located? Tapes, HD, off site...
    - Does the restore work?
    - How long will it take?
      - Check the priority of your restoration jobs especially in Virtual Tape Drives?
    - How long will the recovery take?

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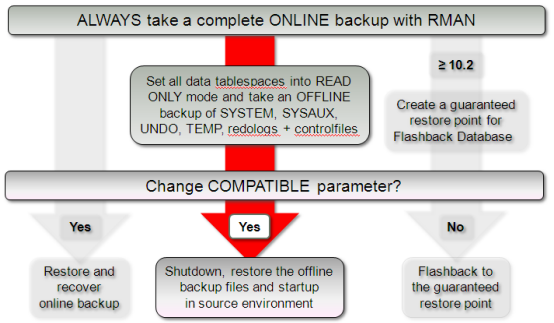
Fallback Strategy

Offline Backup



- No possibility to take a complete backup??
  - Put all data tablespaces into read-only mode
  - Shutdown the database immediate
  - Copy SYSTEM, TEMP, UNDO and SYSAUX datafiles and controlfiles/redologs
  - Startup database again
  - If something fails during the upgrade:
    - Shutdown the database
    - Copy SYSTEM, TEMP, UNDO, SYSAUX, controlfile and redologs from the backup location
    - Startup the database in the old environment
  - Advantages:
    - Fast and simple
    - COMPATIBLE can be changed

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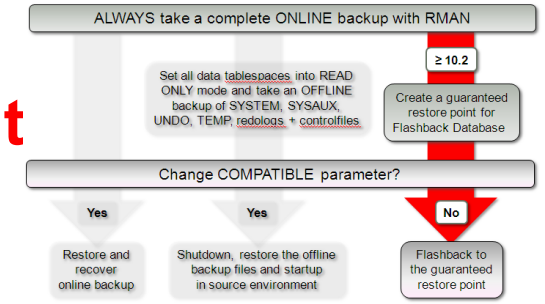
Fallback Strategy

Flashback – Guaranteed Restore Point



- Flashback Database
  - Much faster than restore/recover
    - BUT: Don't change COMPATIBLE
  - A good solution just in case something happens during upgrade
  - Works beginning from 10.2
    - Create a GUARANTEED RESTORE POINT
    - Upgrade your database
    - In case of failure flashback to the restore point
    - In case of success: DON'T FORGET to delete it

```
SQL> CREATE RESTORE POINT grpt
                GUARANTEE FLASHBACK DATABASE;

SQL> FLASHBACK DATABASE TO RESTORE POINT grpt;

SQL> SELECT * FROM V$RESTORE_POINT;
SQL> DROP RESTORE POINT grpt;
```

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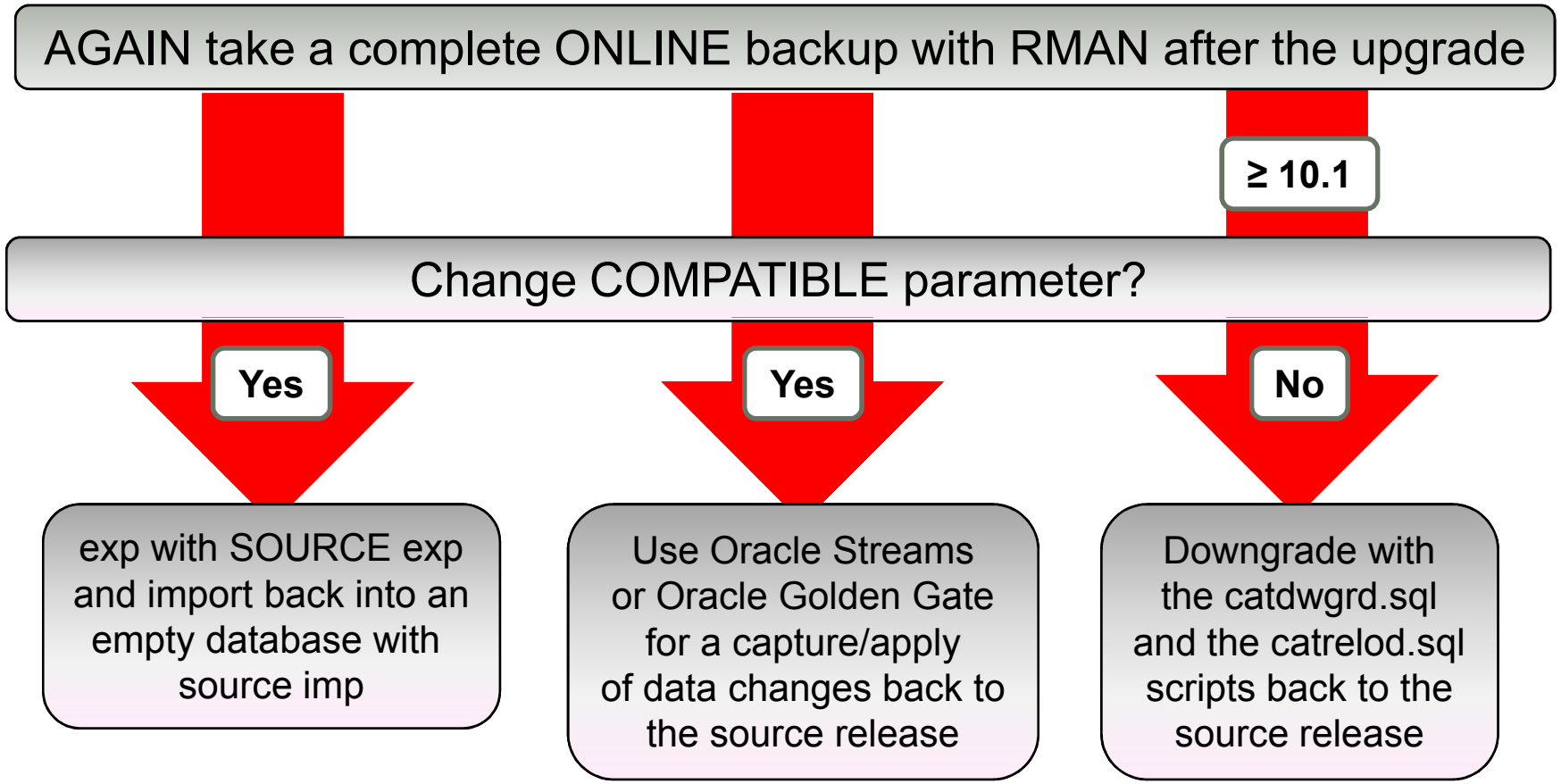
Fallback Strategy – Issues after upgrade

- Assumption: No data loss allowed



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Fallback Strategy - exp/imp

- Downgrade with `exp/imp` to 9.2.0.x
  - Note:158845.1
    - Prepare an empty database for the import just in case you'll have to step back
    - Then:
      - Run the appropiate `?/rdbms/admin/catexp.sql` to create the 9.2 export views in the upgraded database
      - Use "old" 9.2 `exp` for the export
      - Use "old" 9.2 `imp` for the import
    - Annotation for 11.1.0.7:
      See Note:550740.1
      Export from 11g using EXP Utility Version 9iR2 produces corrupt export dump

```
CREATE OR REPLACE VIEW exu9defpswitches (
                  compflgs, nlslensem ) AS
        SELECT    a.value, b.value
        FROM      sys.v$parameter a, sys.v$parameter b
        WHERE     a.name = 'plsql_code_type' AND
                  b.name = 'nls_length_semantics'
/
```

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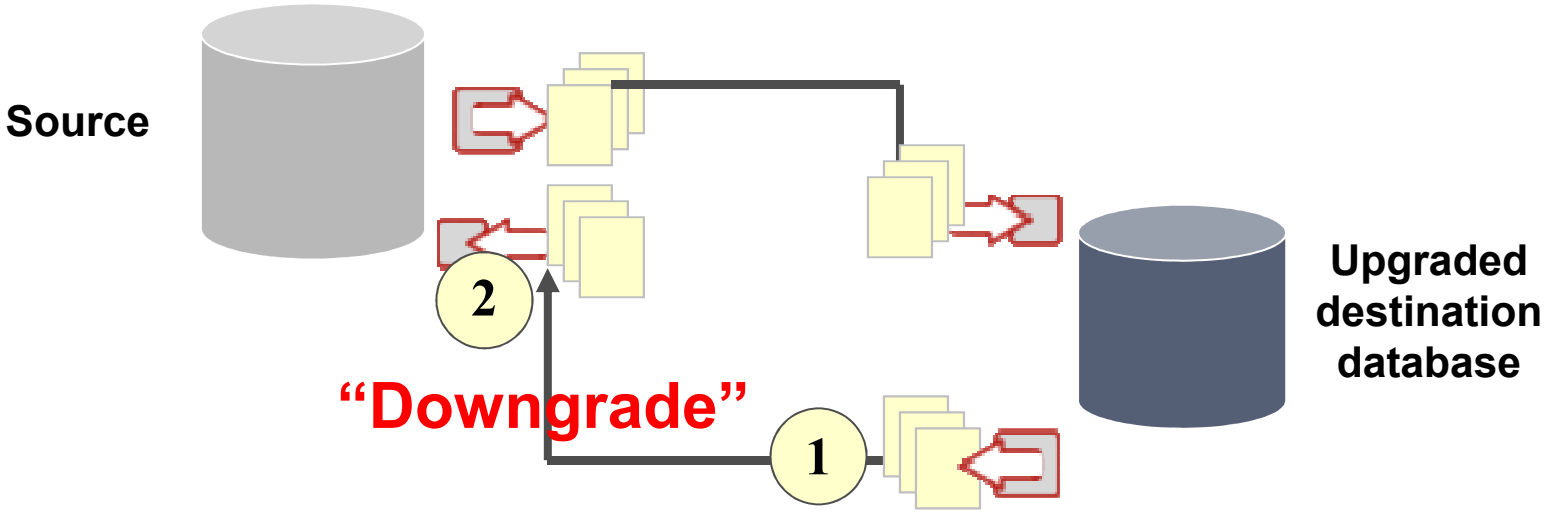
Fallback Strategy – Golden Gate

- Downgrade with Oracle Golden Gate
  - Oracle Streams would be similar in concept



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Fallback Strategy - `catdwgrd.sql`

- Downgrade with **`catdwgrd.sql`**
  - Note:443890.1
    - Downgrade to the release you've upgraded from
      - 10.1.0.5
      - 10.2.0.2/3/4/5
      - 11.1.0.6/7
    - Only possible **if COMPATIBLE hasn't been raised**!!!
      - Please note:
        A downgrade will only be possible to the release you've upgraded from - so if a patch set has been applied always apply it before the upgrade starts - otherwise you'll only be able to downgrade to the release you've patched

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Fallback Strategy - catdwgrd.sql

- Downgrade with catdwgrd.sql to 10g
  - Task in 11g environment:

```
SQL> SPOOL /tmp/downgrade.log
SQL> STARTUP DOWNGRADE
SQL> @catdwgrd.sql
SQL> SPOOL OFF
```

  - Switch to your pre-upgrade 10*g* environment:

```
SQL> STARTUP UPGRADE
SQL> SPOOL /tmp/reload.log
SQL> @catrelod.sql
-- The catrelod.sql script reloads the appropriate version of
-- all of the database components in the downgraded database.
SQL> SPOOL OFF
```

    - Please note: additional steps are required if EM repository resides in the database - please see chapter 6 ***Downgrading a Database*** in the Oracle 11g Upgrade Guide

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Fallback Strategy – Time Zone Patches

- Downgrading time zone changes is not possible
  - If you have upgraded already to the new time zone version with `DBMS_DST` you'll have to apply this TZ version patch to your source home before downgrading!
  - Example:
    - Upgrade from Oracle 10.2.0.4 with DST V4 to Oracle 11.2.0.2 with DST V14
    - Upgraded time zone data types post upgrade
    - In case of downgrade patch DST V14 has to be applied first to the source Oracle 10.2.0.4 home before downgrading the database

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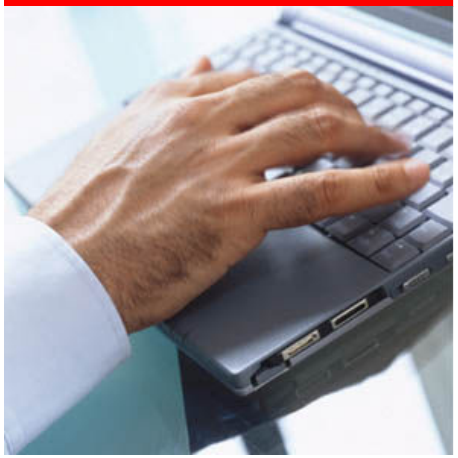
Agenda



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Guidelines

- Never ever change too many system components at once!
- Document all changes detailed and clearly into a change log!
- Always (!!!) use real world data for testing!
- Don't underestimate the test efforts. Reserve enough time and resources for testing.
- ALWAYS collect as much performance data BEFORE the upgrade will be started!!
- Create a fallback strategy!
- PLEASE test your fallback strategy - does it really work??

- Please remember:
  Upgrade has never been easier - but you still have to test!!!

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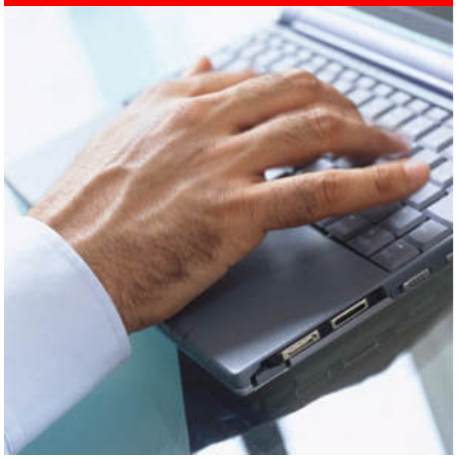
Agenda



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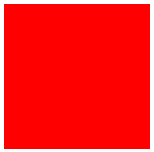

Overview

- 6 customer cases
  1. Move 400 database from 9i to 11g
  2. Move from Single Instance to RAC, ASM and Data Guard
     - And upgrade/patch with 2 minutes downtime
  3. Upgrade 50 DWHs from 10.2 to 11g – fully unattanded
  4. Upgrade from 10.2.0.3 RAC to 11.1.0.7 RAC and get tremendous performance
  5. Move 7TB from Oracle 9.2 to Exadata V1 in 24 hours
     - Cross-platform
     - Cross-Endianness
     - Cross-Version
  6. Move 10.1.0.5 RAC to 11.2.0.2 RAC on new hardware
     - Less than 4 hours downtime

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400 databases from 9i to 11g

- Customer facts & figures
  - One of the most important international retailing companies
  - 2,195 outlets in 32 countries in Europe, Africa and Asia
  - ~290,000 employees
  - Revenue in 2008: € 68 billion

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400 databases from 9i to 11g

- Tech facts:
  - Oracle 9.2.0.8
  - 400 databases
    - IBM AIX5L servers - each running 3 databases
    - Each database hosting 10 retail stores
  - Nightly OLTP batches
    - 25 GB redo per batch
    - Extremely tight timing constraints
  - Experience in the past when upgrading from 8.1.7 to 9.2:
    - Optimizer issues
    - Application changes were necessary

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400 databases from 9i to 11g

- Goal:
  - Upgrade directly from Oracle 9*i* to Oracle Database 11*g*
  - Leverage new 11*g* features for performance optimization
    - Automatic SQL Profiling
  - Use SQL Performance Analyzer
    - Detection of plan changes
  - Use Database Replay
    - Functional Tests
  - Automate all steps for reusability

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400 databases from 9i to 11g

- Setup:
  - IBM P670 - 16 CPUs - 32 GB RAM
  - EMC Storage DMX2000
  - 3 production database copies (Oracle 9.2.0.8)
  - Recorded nightly batch run - can be replayed anytime
    - Reference run time of batch run: *1:45:03*

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Real World Experience: Upgrade

- Upgrade directly from Oracle 9.2.0.8 to 11.1.0.6
  - Upgrade has been done with catupgrd.sql as part of a shell script starting a backup and doing additional sanity operations
  - Result:
    - Extremely easy
    - Just a few patches were necessary - no show-stoppers
    - Fully scriptable
    - Production rollout will be with 11.1.0.7

```
Component                          Status         Version  HH:MM:SS
Oracle Server                       VALID      11.1.0.6.0  03:06:48
JServer JAVA Virtual Machine        VALID      11.1.0.6.0  00:15:43
Oracle Workspace Manager            VALID      11.1.0.6.0  00:01:38
Oracle XDK                          VALID      11.1.0.6.0  00:35:35
Oracle XML Database                 VALID      11.1.0.6.0  00:04:28
Oracle Database Java Packages       VALID      11.1.0.6.0  00:00:33
Oracle Multimedia                   VALID      11.1.0.6.0  00:05:49
Spatial                             VALID      11.1.0.6.0  00:08:53
Gathering Statistics                                       00:08:18

Total Upgrade Time: 04:27:49
```

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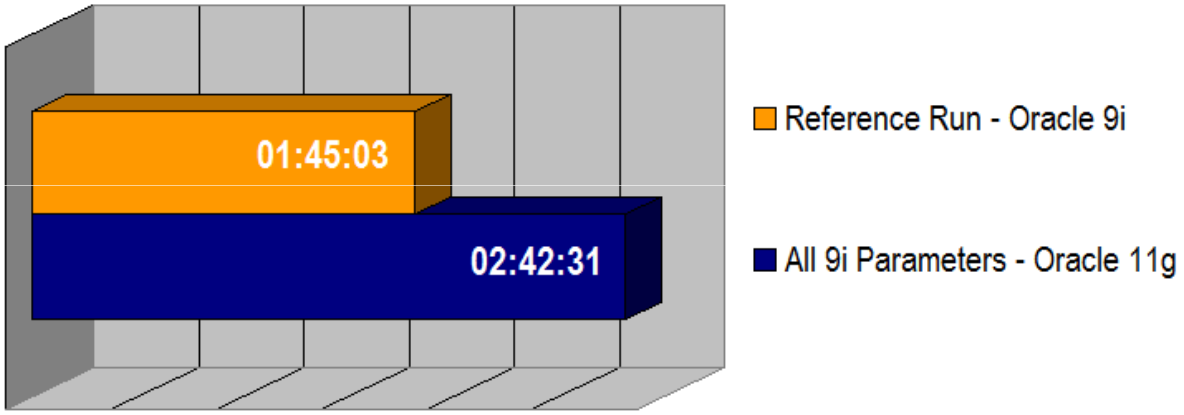
Test run 1: Use all 9i parameters

- Database successfully upgraded to 11g
- No adjustments had been done except for the required changes like `diagnostic_dest`
- Result:



- Conclusion:
  - While upgrade went very smoothly some tuning is clearly needed

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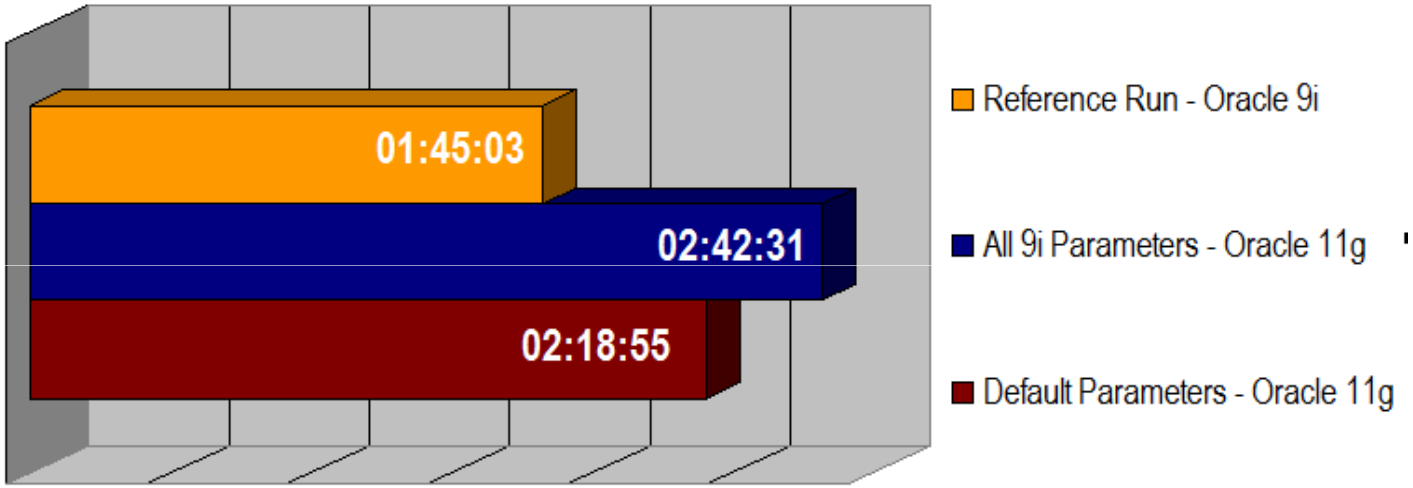
Test run 2: Use 11g defaults

- Database successfully upgraded to 11g
- Oracle Database 11g default parameters have been set
- Result:



- Conclusion:
  - It is recommended to remove relics from previous releases and start with the 11g defaults

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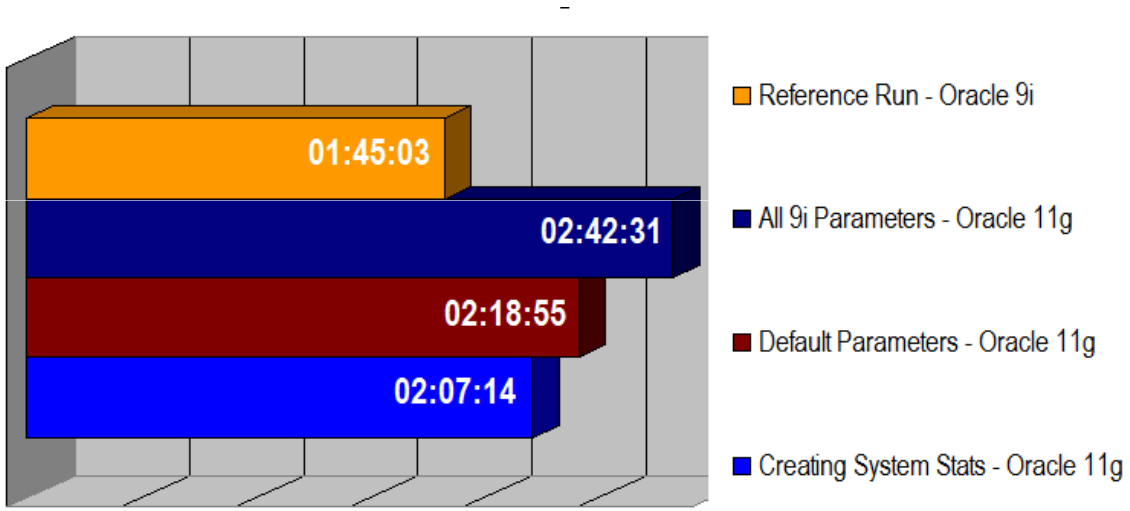
Test run 3: Create system statistics

- System statistics get created for a workload period
  - `exec DBMS_STATS.GATHER_SYSTEM_STATS('start');`
  - `exec DBMS_STATS.GATHER_SYSTEM_STATS('stop');`
  - See view `AUX_STATS$`
- Result:



- Conclusion:
  - Valid system statistics will help the optimizer to find better execution plans

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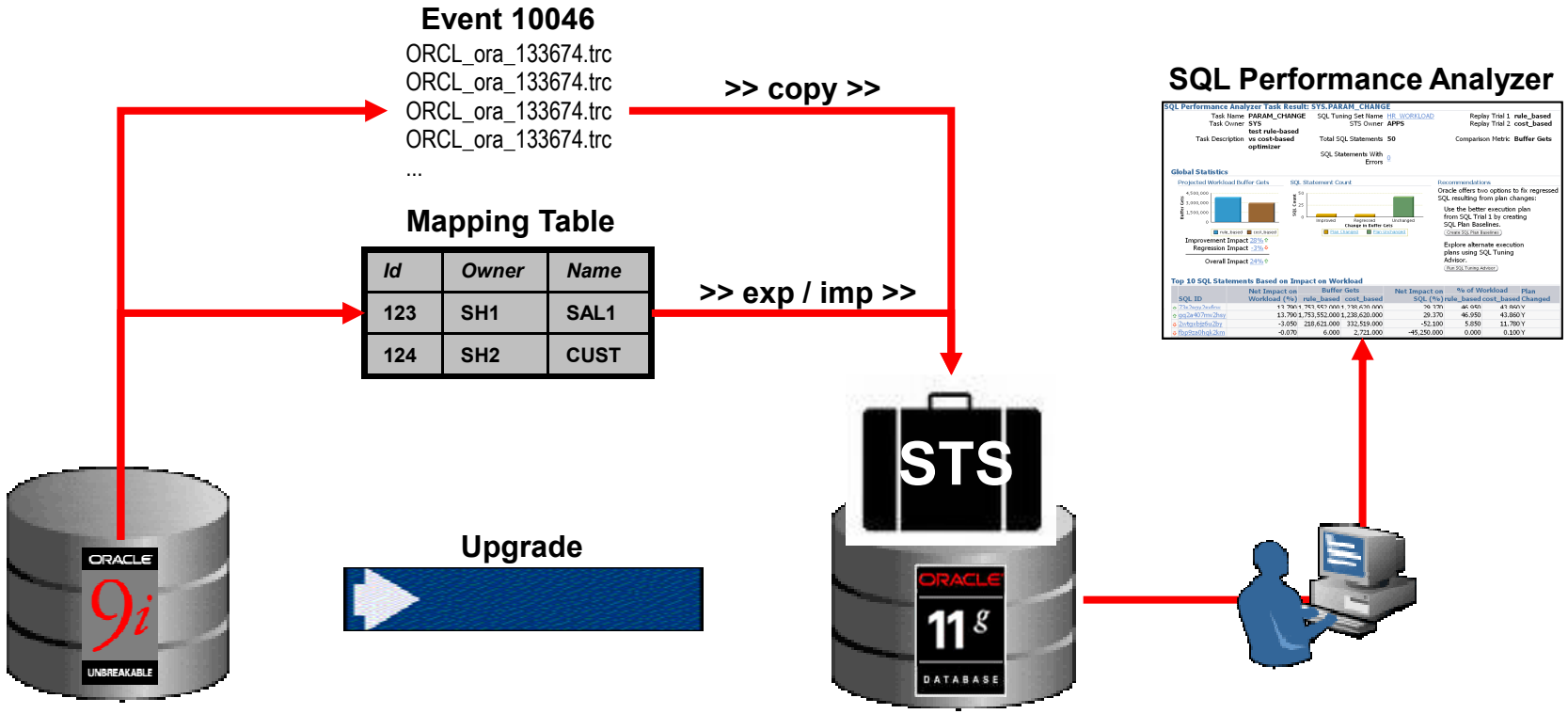
Test run 4: init.ora optimization with SPA

- Using the SQL Performance Analyzer for 9i ⇨11g



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Test run 4: init.ora optimization with SPA

- Using SPA reports to find the ideal init.ora settings:

⇩Parameters / Reports ⇨	CPU_TIME	BUFFER_GETS
optimizer_features_enable=9.2.0	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 2127 Improved 750 734 Regressed 302 260 Unchanged 1235 1133	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 2127 Improved 1219 1125 Regressed 116 80 Unchanged 952 922
optimizer_features_enable=11.1.0.6	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 1704 Improved 775 640 Regressed 207 173 Unchanged 1305 891	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 1704 Improved 1139 899 Regressed 170 143 Unchanged 978 662
optimizer_index_cost_adj=75	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 1174 Improved 827 649 Regressed 181 100 Unchanged 1373 425	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 1174 Improved 1175 881 Regressed 142 110 Unchanged 970 183
optimizer_mode=first_rows_10	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 1707 Improved 821 687 Regressed 158 126 Unchanged 1308 894	SQL Statement Count SQL Category / SQL Count / Plan Change Count Overall 2397 1707 Improved 1085 845 Regressed 145 118 Unchanged 1057 744

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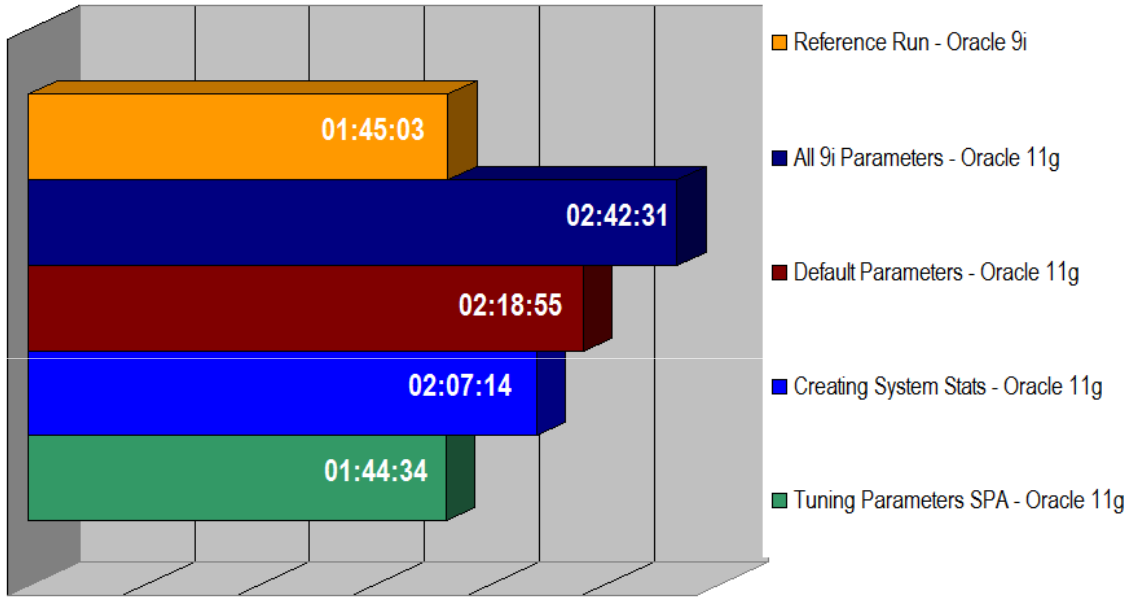
Test run 4: init.ora optimization with SPA

- Using SPA to optimize the init.ora
- Result:



- Conclusion:
  - SPA is a great tool to detect plan regressions before the upgrade

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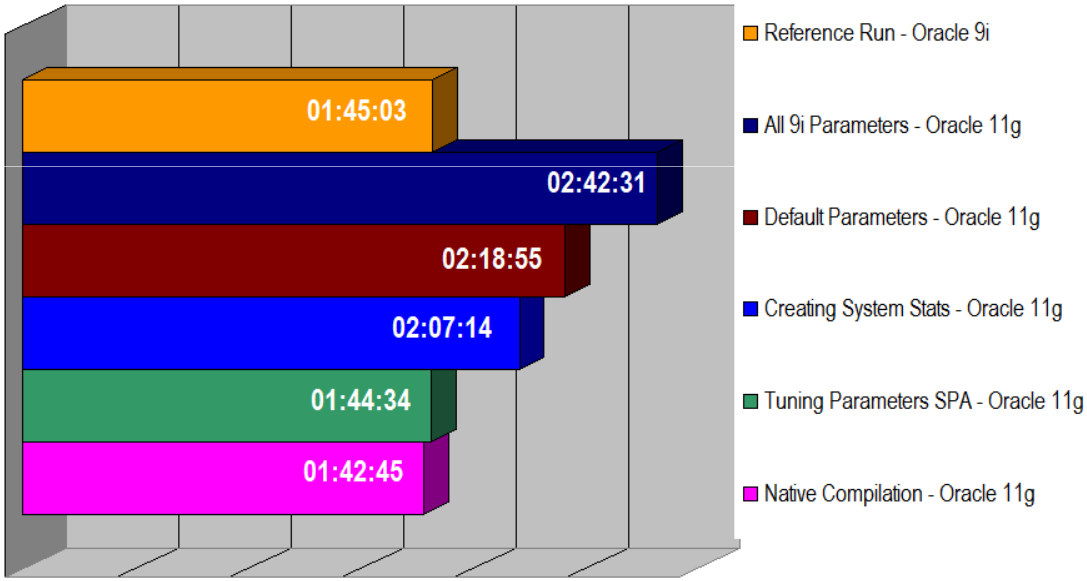
Test run 5: PL/SQL Native Compilation

- PL/SQL native compilation parameters:
  - `plsql_code_type=native`
  - `plsql_optimize_level=3`
  - Recompilation: `exec DBMS_UTILITY.COMPILE_SCHEMA('<username>');`
- Result:



- Conclusion:
  - Native compilation lead to a slightly better overall completion timing

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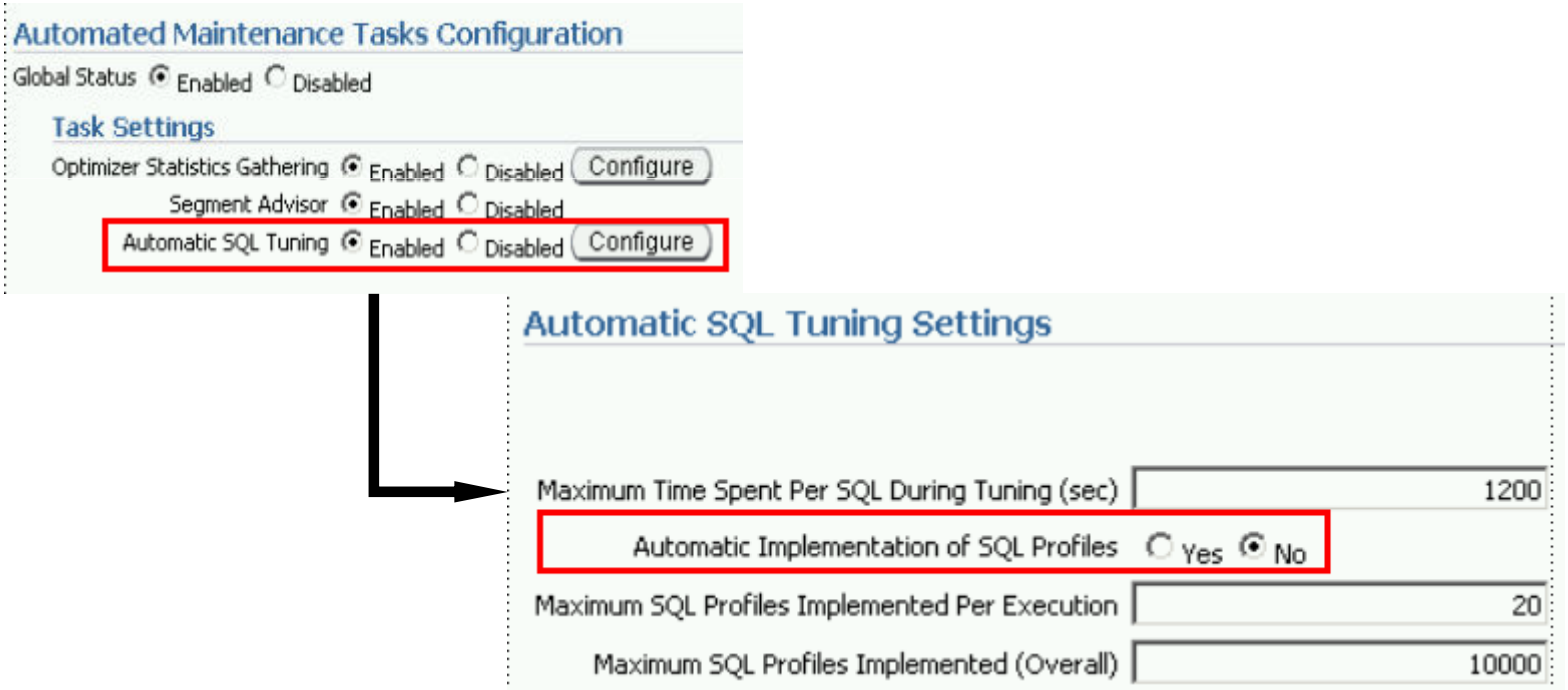
Test run 6: SQL Profiling

- Automatic SQL Tuning switched on
  - Upon every AWR snapshot the database will evaluate high-load SQL from the snapshot as possible candidates for the SQL Tuning Advisor
  - Goal is to create SQL Profiles automatically



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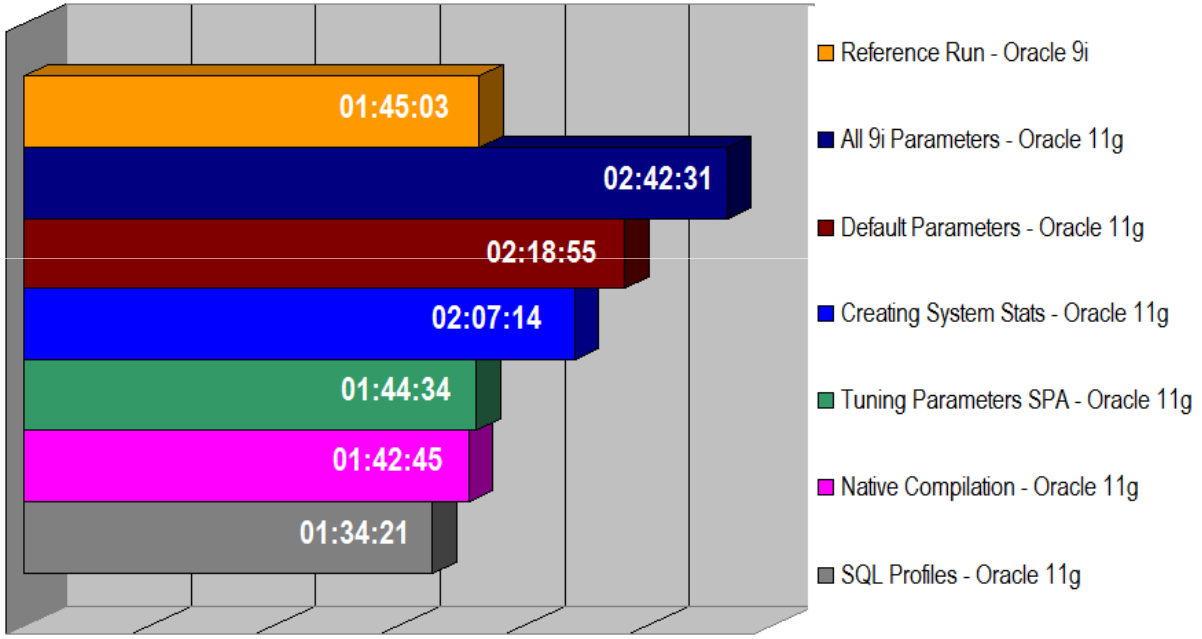
Test run 6: SQL Profiling

- Automatic SQL Tuning switched on
  - Performance boost with 6 SQL Profiles - no DBA intervention necessary
  - No changes to the applications were required
- Result:



- Conclusion:
  - SQL Profiling speeds up SQL but doesn't change the application!!!

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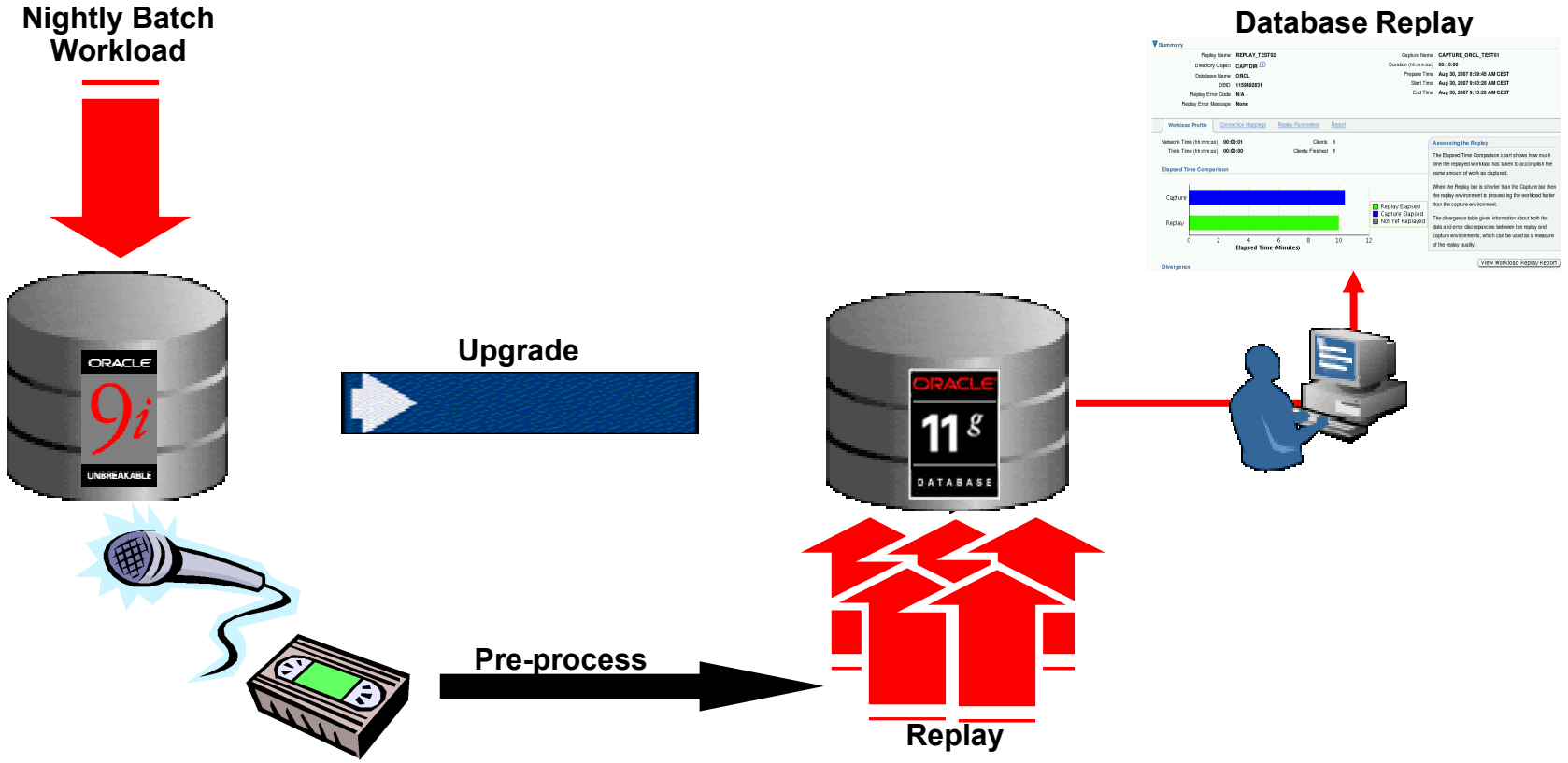
Real World Experience: Database Replay

- Using Database Replay for 9i ⇨11g



- Conclusion: No application changes were necessary

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Real World Experience: Results

- Upgrade directly from Oracle 9.2.0.8 to 11.1.0.7
  - Works extremely well and easier than expected
- SQL Performance Analyzer
  - Helps to detect plan changes right before the upgrade
  - Does a great job to optimize the init.ora
- Database Replay
  - Ensures that all application statements complete error-free
- SQL Profiling
  - Speed up queries and reports
- **50% less testing effort for upgrades to the new release**
- **Biggest surprise: No application changes necessary**
- **Production rollout has been started in May 2009**

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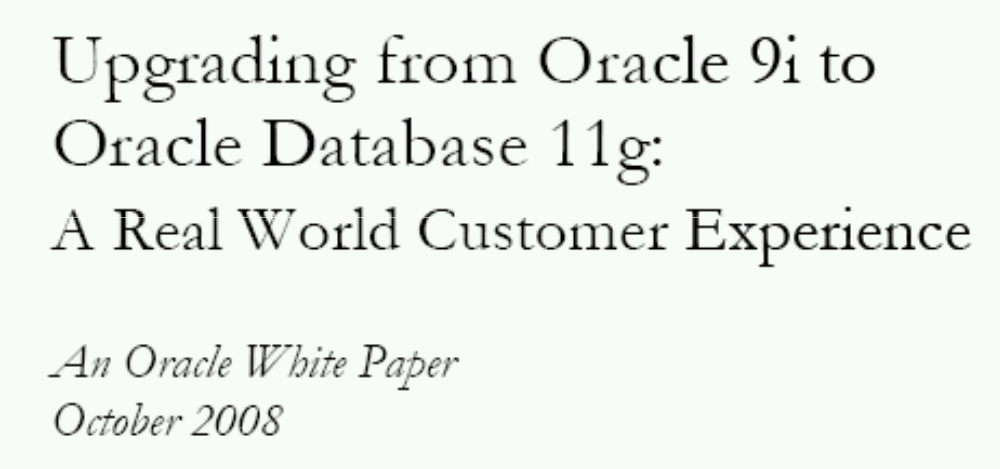
Real World Experience

- White Paper available on OTN
  - http://www.oracle.com/technetwork/database/features/manageability/9i-to-11g-real-world-customer-exper-133754.pdf


Upgrading from Oracle 9i to Oracle Database 11g:
A Real World Customer Experience

An Oracle White Paper
October 2008

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Universität Bielefeld

"Moving directly from Oracle 9i to Oracle Database 11g with Real Application Clusters, ASM and Data Guard was much easier and smoother than we'd expected."

Dr. Lars Köller
Departmental Manager
Computing Center
Bielefeld University

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Project 2: Bielefeld University

- Bielefeld University
  - 18000 students
  - 1500 employees
  - Initiative of Excellence
  - Bielefeld University will lead the way for 23 universities in Germany
- Setup before the upgrade:
  - Sun Solaris - Sun hardware
  - 10 databases - all Oracle 9.2.0.8
  - Highly critical applications
- Goals:
  - Move from single instance to RAC with ASM and Data Guard
  - Ensure very good performance
  - Run different Oracle versions in the same RAC environment

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Project 2: Bielefeld University

- 5 phases:
  - Setup phase
  - Test phase
  - Performance phase
  - High Availability phase
  - Rollout phase

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Project 2: Setup phase

- Phase 1 - Setup:
  - 2-node Sun Solaris cluster with shared storage
  - 3x Oracle 11.1.0.6 homes
    - 1 for the Oracle Clusterware
    - 1 for ASM
    - 1 as Database Home
  - 1x Oracle 10.2.0.4 home
  - 1 powerful Solaris machine has been set up as well to handle the standby
  - Identical test systems setup as well
  - Monitoring with Oracle Grid Control 10.2.0.4. and Grid Control 10.2.0.4 agents

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Project 2: Test phase

- Phase 2 - Test:
  - All current database were successfully either upgraded or migrated (UTF8 changes involved) to their target releases
  - Mission-critical applications such as the University Class Schedule, the Central User Management System and the web presence received careful testing with internal test tools
    - Only a few changes were required because of the character set conversion

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Project 2: Performance phase

- Phase 3 - Performance:
  - Using the SQL Performance Analyzer (SPA) to detect plan regressions and to perfect performance:

Initial run – no tuning:

SQL Statement Count

SQL Category	SQL Count	Plan Change Count
Improved	624	384
Regressed	147	74
Unchanged	1742	1132

Second run – init.ora tuning:

SQL Statement Count

SQL Category	SQL Count	Plan Change Count
Improved	658	410
Regressed	99	45
Unchanged	1756	1138

Third run: final changes:

SQL Statement Count

SQL Category	SQL Count	Plan Change Count
Improved	642	394
Regressed	94	48
Unchanged	1777	1151

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Project 2: Performance phase

- Phase 3 - Performance:
  - Remedy the remaining 94 regressed statements with SQL Tuning Advisor
    - 34 SQL Profiles had been found and implemented
    - Some speed up SQL statement's performance by 99%

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Project 2: High Availability phase

- Phase 4 - High Availability:
  - Standby database has been built up with RMAN automatically
  - Since Oracle 11g RMAN is able to build up the standby from the current production database without taking a backup and restores the standby through network transfer
  - Target: *Rolling Upgrade with a Transient Standby* will be used to apply patch set 11.1.0.7 with only 2 minutes of downtime
    - http://www.oracle.com/technetwork/database/features/availability/maa-wp-11g-transientlogicalrollingu-1-131927.pdf

Database Rolling Upgrade Using
Transient Logical Standby:
Oracle Data Guard 11g
Oracle Maximum Availability Architecture White Paper
September 2008

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Project 2: Rollout phase

- Phase 5 - Rollout:
  - Go-live date: 12-September 2008
  - Rollout finished mid-October 2008
  - Already highest load on the system during start of the winter semester
    - 30% more logins
    - Response times decreased by 50%
  - Rolling Upgrade with a Transient Standby done:
    - Friday, 13th of February 2009

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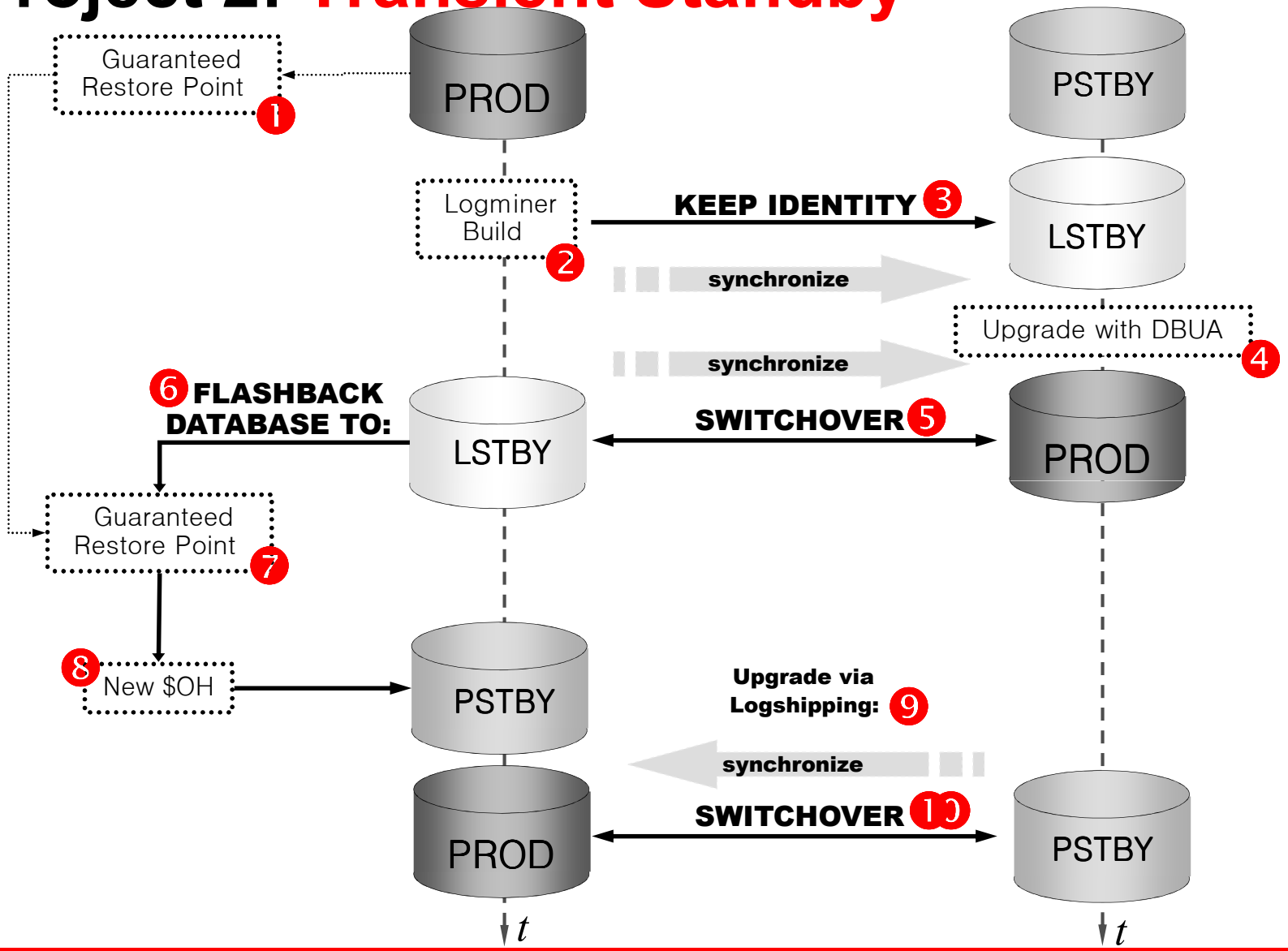
Project 2: Transient Standby



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Project 3: Upgrading 50 DWHs unattended

- **Anritsu** Italy

  - ~50 DWH solutions mostly installed at large TelCos
  - Database sizes vary between 8 TB and 12 TB
  - Application monitors network performance and bottlenecks
  - Up to 200,000 partitions in the database
- Goal:
  - Upgrade all databases from 10.2.0.2 to 11.1.0.7
  - Platform is RH Linux 64bit
  - Installation, configuration and upgrade: unattended

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Project 3: Upgrading 50 DWHs unattended

- Silent installation:
  - Record a response file with OUI:
    `./runInstaller -record -destinationFile /tmp/inst.rsp`
  - Customize the response file and use it for an unattended installation:
    `./runInstaller -silent -responseFile /tmp/inst.rsp`
- Silent patch installation:
  - Install patch set with OUI in record mode and use the response file for a silent installation of the patch set
- Silent listener configuration:
  - Modify the delivered NETCA response file
  - Run: `./netca /silent /responseFile netca.rsp`

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Project 3: Upgrading 50 DWHs unattended

- Silent upgrade with DBUA:
  -
```
dbua -silent -sid dwh
     -oracleHome /opt/oracle/product/RDBMS10g
     -diagnosticDest /opt/oracle/diag
     -sysDBAUserName sys
     -sysDBAPassword manager
     -recompile_invalid_objects true
     -degree_of_parallelism 4
     -emConfiguration LOCAL
          -dbsnmpPassword manager
          -sysmanPassword manager
```

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Project 3: Upgrading 50 DWHs unattended

- First successful production upgrade to 11.1.0.7 done: 22th of November 2008

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Project 4: 10.2.0.3 => 11.1.0.7

- Deutsche Messe is the largest trade fair worldwide
  - Key trade fairs:
    - CeBIT
    - Hannover Messe
  - ~500,000 m² exhibition space
- Motivation to upgrade to Oracle Database 11g
  - Move from raw devices to 11g ASM
  - Automatic SQL Tuning
  - Snapshot Standby
- 3-node RAC with Oracle Database 10.2.0.3

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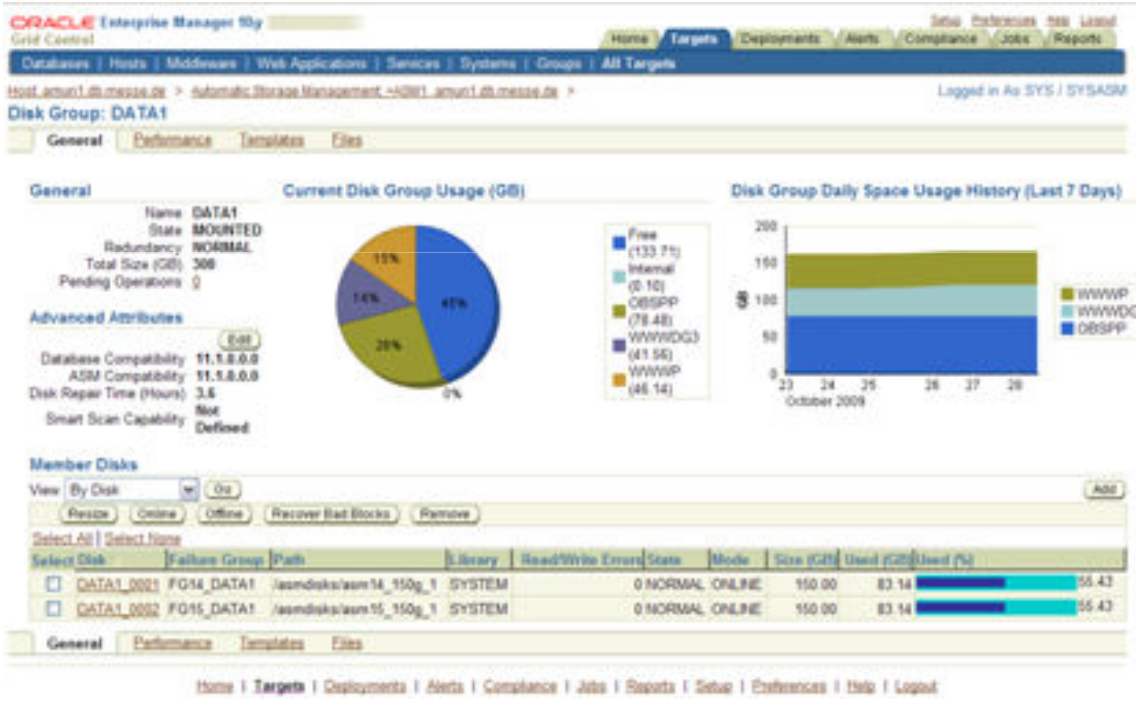
Project 4: Deutsche Messe

Deutsche Messe
Hannover · Germany

- Real world example: ASM Management in Grid Control
  - Much easier to manage
  - HA features: Fast Mirror Resynch & Preferred Read



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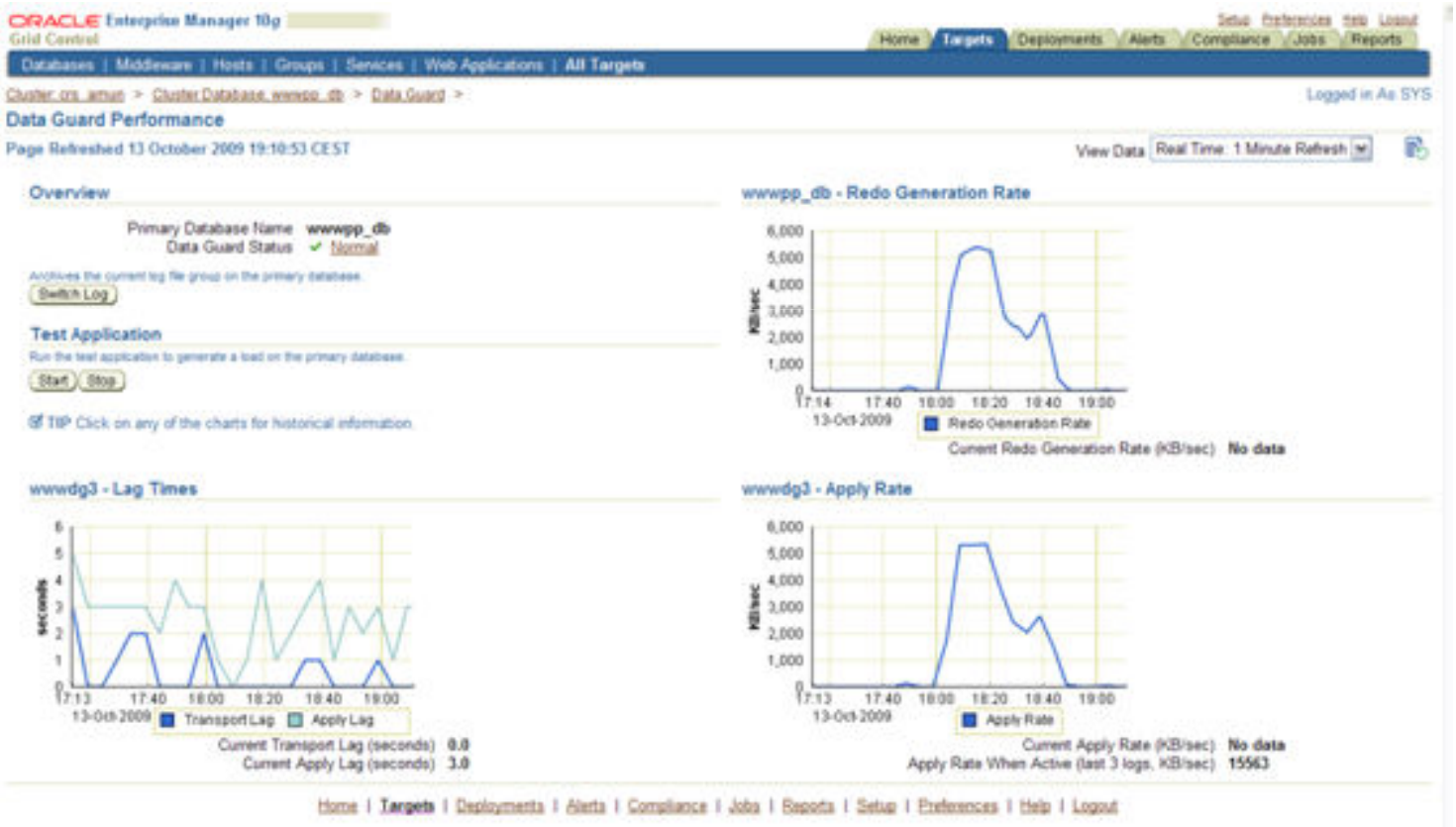
Project 4: Deutsche Messe

Deutsche Messe
Hannover · Germany

- Real world example: Data Guard with Snapshot Standby
  - Convert standby database to test database with one click/command



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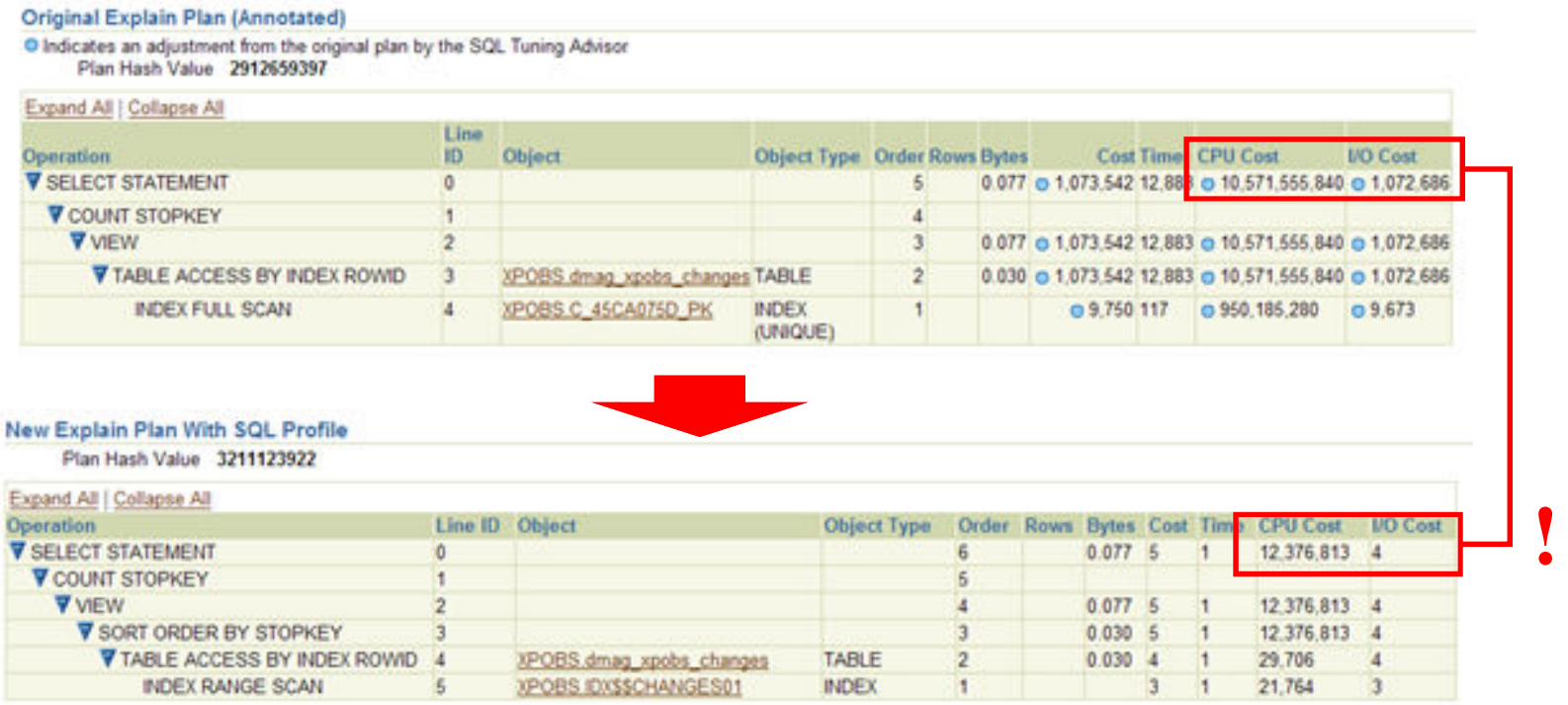
Project 4: Deutsche Messe

Deutsche Messe
Hannover · Germany

- Real world example: Automatic Tuning with Tuning Pack



Original Explain Plan (Annotated)

Indicates an adjustment from the original plan by the SQL Tuning Advisor

Plan Hash Value 2912659397

Expand All | Collapse All

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
SELECT STATEMENT	0			5		0.077	1,073,542	12,88	10,571,555,840	1,072,686
COUNT STOPKEY	1			4						
VIEW	2			3		0.077	1,073,542	12,883	10,571,555,840	1,072,686
TABLE ACCESS BY INDEX ROWID	3	XPOBS.dmag_xpobs_changes	TABLE	2		0.030	1,073,542	12,883	10,571,555,840	1,072,686
INDEX FULL SCAN	4	XPOBS.C_45CA075D_PK	INDEX (UNIQUE)	1			9,750	117	950,185,280	9,673

New Explain Plan With SQL Profile

Plan Hash Value 3211123922

Expand All | Collapse All

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
SELECT STATEMENT	0			6		0.077	5	1	12,376,813	4
COUNT STOPKEY	1			5						
VIEW	2			4		0.077	5	1	12,376,813	4
SORT ORDER BY STOPKEY	3			3		0.030	5	1	12,376,813	4
TABLE ACCESS BY INDEX ROWID	4	XPOBS.dmag_xpobs_changes	TABLE	2		0.030	4	1	29,706	4
INDEX RANGE SCAN	5	XPOBS.IDX$$CHANGES01	INDEX	1			3	1	21,764	3

!

- Improvement: factor 250,000!!!
  - Third party application

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Project 4: Deutsche Messe

Deutsche Messe
Hannover · Germany

- Result:
  - Upgrade has been done with Data Pump to consolidate space
  - Go-live on 11.1.0.7 in September/October 2009
  - Performance is excellent – no need to change hardware
- Current status:
  - Highest load happened in March 2010 during CeBIT
    - No problem at all ☺
  - Current PSU has been applied by a rolling upgrade
  - Tests with 11.2.0.2 have been started already

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Project 5: Move to Exadata V1

LOYALTY PARTNER SOLUTIONS

- LOYALTY PARTNER SOLUTIONS

=> Payback bonus card program PAYBACK

  - Setup:
    - Source: 7 TB and 1.5 TB on HP-UX PA-RISC with Oracle 9.2.0.7
    - Target: Exadata V1, i.e. Oracle Enterprise Linux 64bit with Oracle Database 11.1.0.7
  - Restrictions:
    - 24 hour downtime window
    - 4 months planning and migration phase
      - August – November 2009
    - Fallback
      - Parallel processing for 1 month
    - Proposed go-live date: 15-NOV-2009

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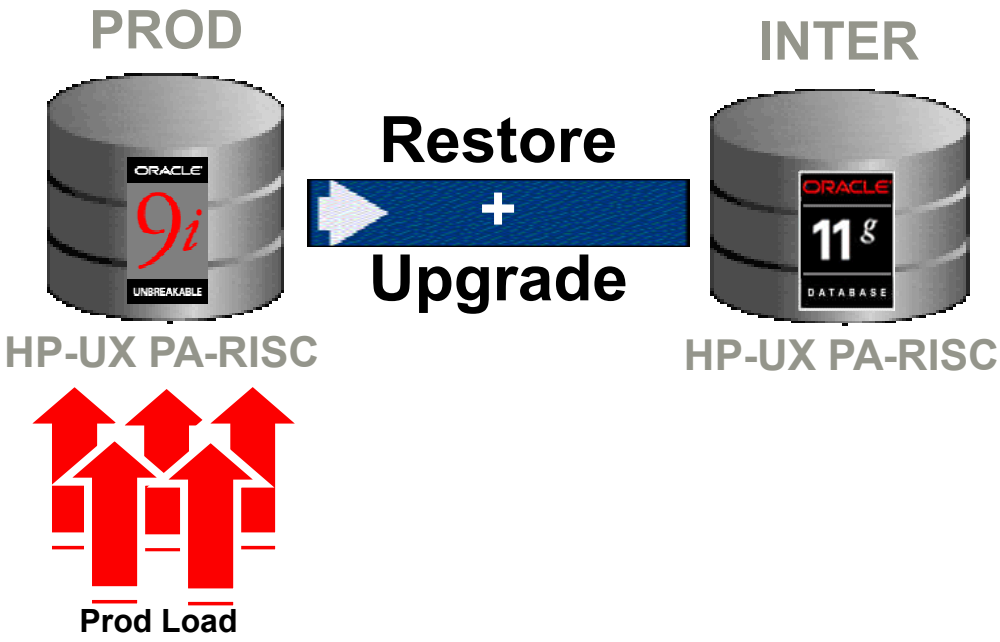
Project 5: Move to Exadata V1

LOYALTY PARTNER SOLUTIONS

- Step-by-step
  1. Build up an intermediate system
  2. Restore the backup to the intermediate system
  3. Upgrade this database to 11.1.0.7



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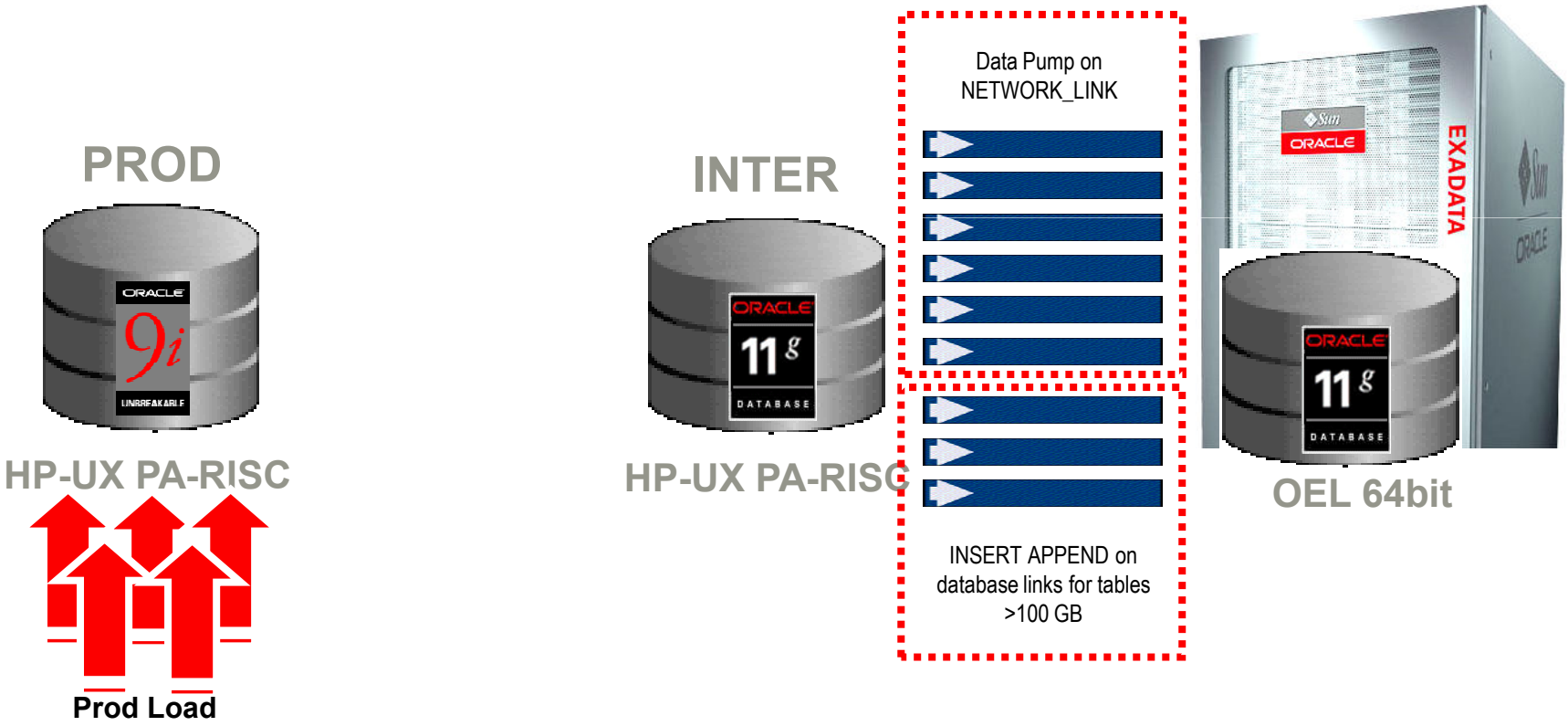
Project 5: Move to Exadata V1

LOYALTY PARTNER SOLUTIONS

- Step-by-step
  4. Move schemas and data with Data Pump using NETWORK_LINK
  5. Move larger tables (>100GB) using database links



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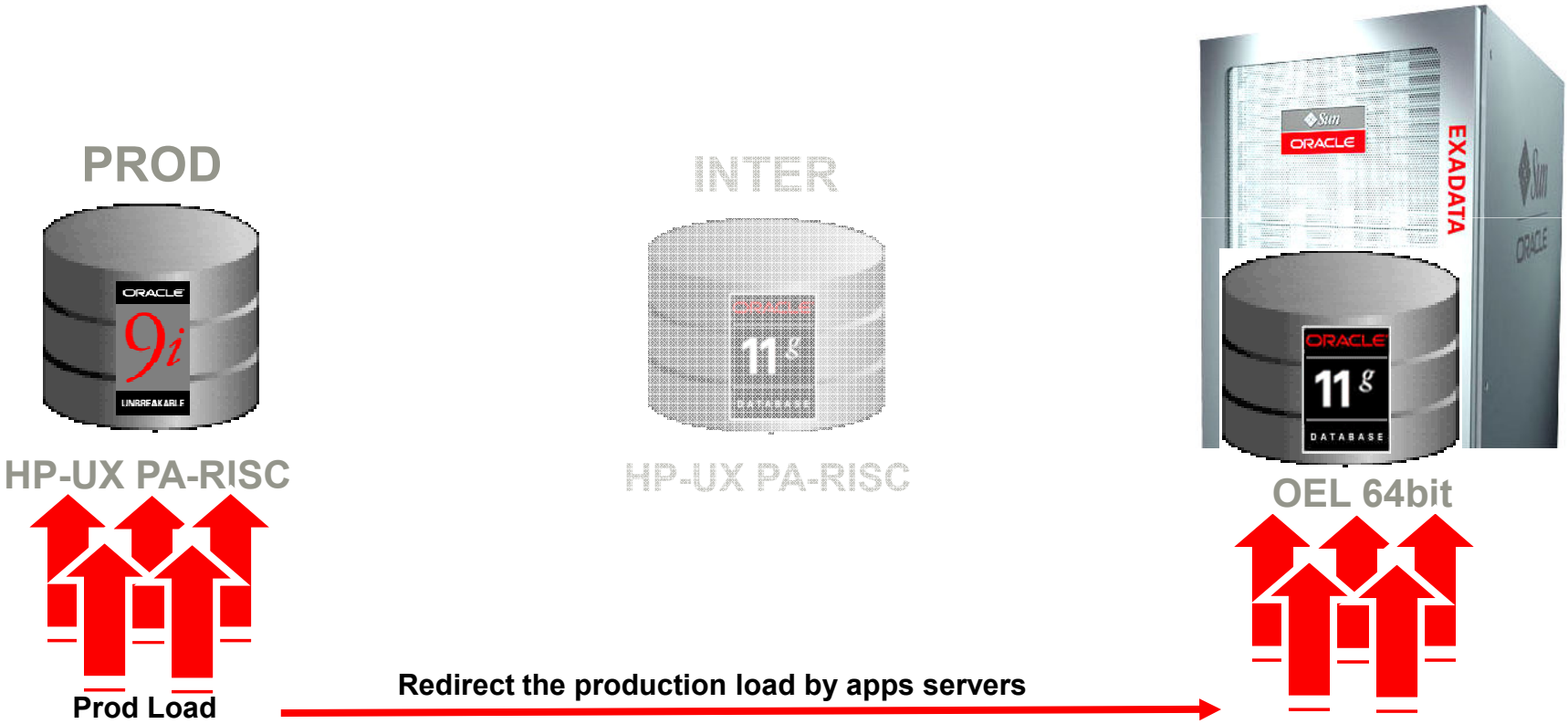
Project 5: Move to Exadata V1

LOYALTY PARTNER SOLUTIONS

- Step-by-step
  6. Test by running the production load on the Exadata V1 as well
  7. Run all reports and evaluations on Exadata V1 as well



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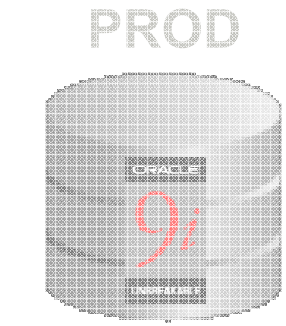
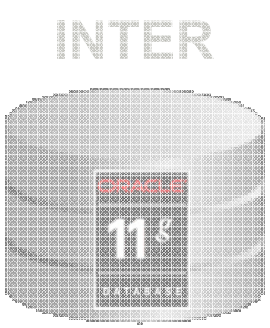
Project 5: Move to Exadata V1

LOYALTY PARTNER SOLUTIONS

- Step-by-step
  8. Went live two weeks earlier
  9. Dramatic performance improvement on Exadata
     - Jobs went from 32 hours to 2 hours
     - User complained about too fast performance





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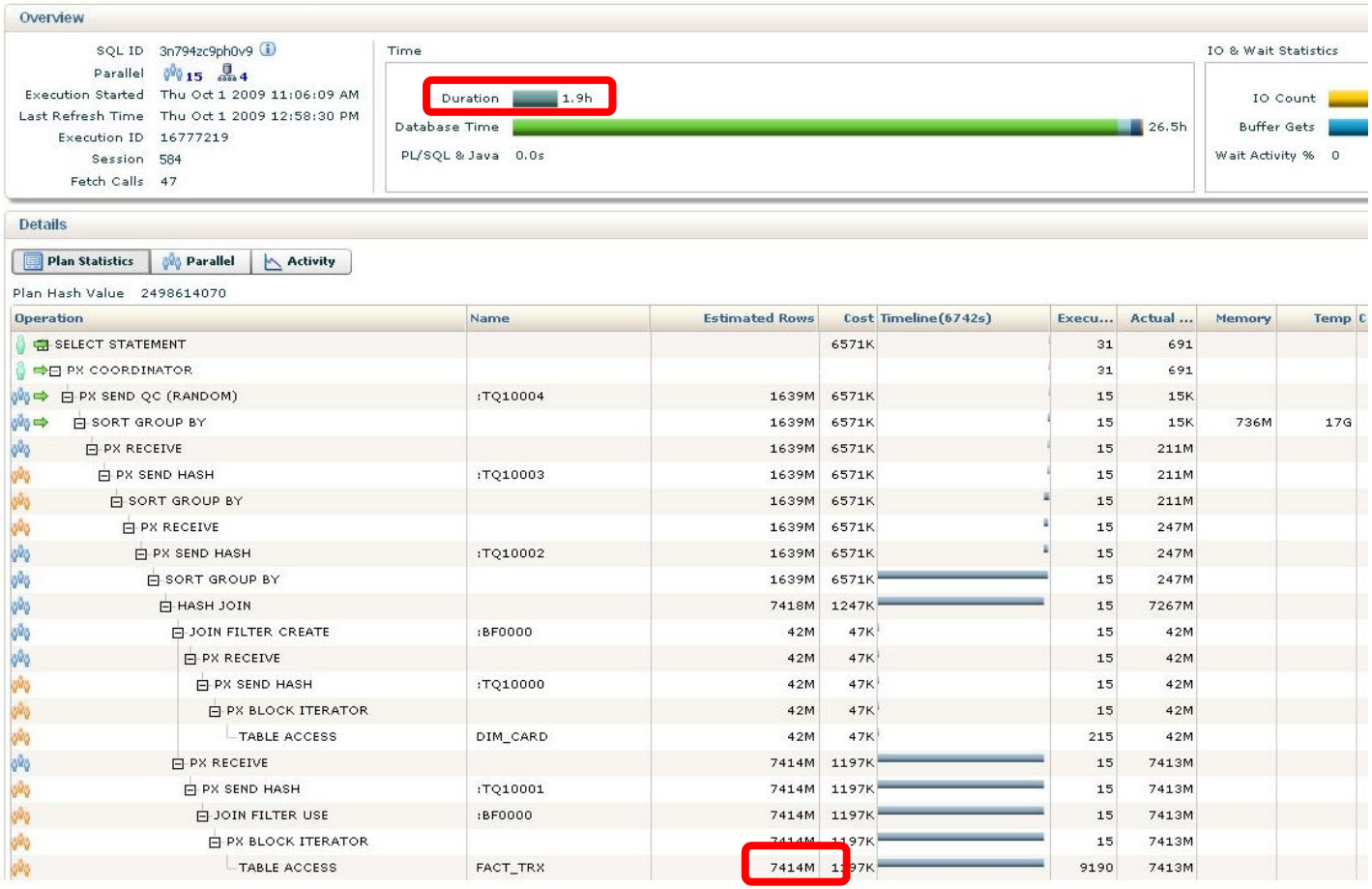
Project 5: Move to Exadata V1

LOYALTY PARTNER SOLUTIONS

- Example: Performance gain ➔ 30hrs vs 2hrs



Overview

SQL ID	3n794zc9ph0v9
Parallel	15 4
Execution Started	Thu Oct 1 2009 11:06:09 AM
Last Refresh Time	Thu Oct 1 2009 12:58:30 PM
Execution ID	16777219
Session	584
Fetch Calls	47

Time

Duration	1.9h
Database Time	26.5h
PL/SQL & Java	0.0s

IO & Wait Statistics

IO Count	
Buffer Gets	
Wait Activity %	0

Details

Plan Statistics | Parallel | Activity

Plan Hash Value 2498614070

Operation	Name	Estimated Rows	Cost	Timeline(6742s)	Execu...	Actual ...	Memory	Temp
SELECT STATEMENT			6571K		31	691		
PX COORDINATOR					31	691		
PX SEND QC (RANDOM)	:TQ10004	1639M	6571K		15	15K		
SORT GROUP BY		1639M	6571K		15	15K	736M	17G
PX RECEIVE		1639M	6571K		15	211M		
PX SEND HASH	:TQ10003	1639M	6571K		15	211M		
SORT GROUP BY		1639M	6571K		15	211M		
PX RECEIVE		1639M	6571K		15	247M		
PX SEND HASH	:TQ10002	1639M	6571K		15	247M		
SORT GROUP BY		1639M	6571K		15	247M		
HASH JOIN		7418M	1247K		15	7267M		
JOIN FILTER CREATE	:BF0000	42M	47K		15	42M		
PX RECEIVE		42M	47K		15	42M		
PX SEND HASH	:TQ10000	42M	47K		15	42M		
PX BLOCK ITERATOR		42M	47K		15	42M		
TABLE ACCESS	DIM_CARD	42M	47K		215	42M		
PX RECEIVE		7414M	1197K		15	7413M		
PX SEND HASH	:TQ10001	7414M	1197K		15	7413M		
JOIN FILTER USE	:BF0000	7414M	1197K		15	7413M		
PX BLOCK ITERATOR		7414M	1197K		15	7413M		
TABLE ACCESS	FACT_TRX	7414M	1197K		9190	7413M		

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Project 6: Interhyp

- Interhyp does residential and development financing
  - Offering banking service to other German key banks as well
  - Headquartered in Munich/Germany
  - 100% subsidiary of Dutch ING Bank
- Tech setup:
  - 6x 2-node-RAC systems on Oracle 10.1.0.5 on RH Linux 32bit
    - Clustered File System
- Target:
  - Oracle RAC 11.2.0.2 with ASM
  - RH Linux 64bit
    - Hardware exchange for key systems ⇨ 4-node cluster
  - Maximum downtime: 4 hours
  - Keep “old” system as fallback

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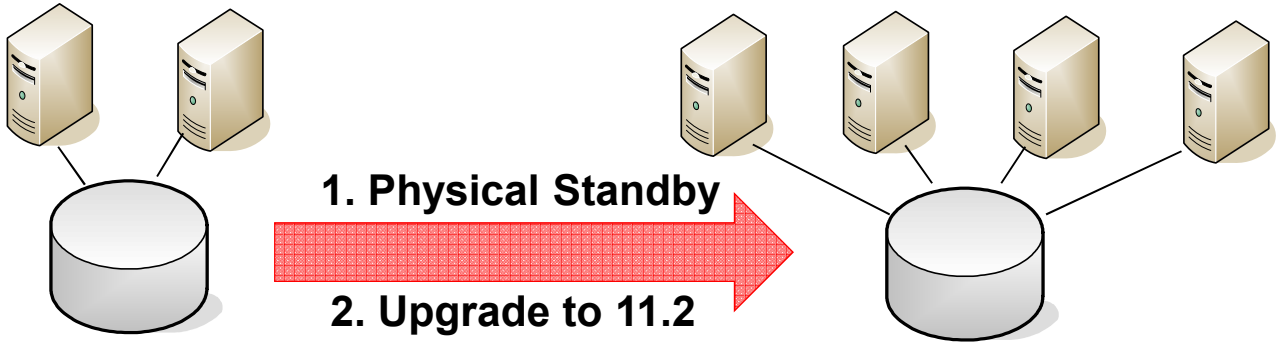
Project 6: Interhyp

- Road to success:
  - Install Grid Infrastructure 11.2 on new hardware and patch it
  - Remove unused components from production database
    - Goal: Decrease upgrade duration to ~30 minutes
  - Build a physical standby database (10.1.0.5 ⇨ 10.1.0.5) in 11.2 ASM
  - Activate the standby and start in `STARTUP UPGRADE` mode
    - Invalidate and compile all packages/code (32bit ⇨ 64bit!)
  - Register database to Clusterware and move OCR/Voting to ASM



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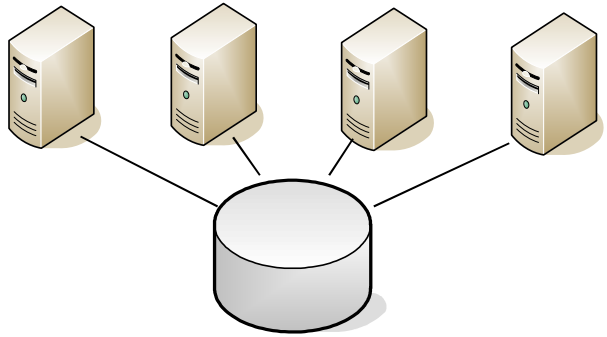
Project 6: Interhyp

- Road to success:
  - Go Live: 27-NOV-2010
  - Total downtime: ~2 hours
  - Database upgrade time: 24 minutes + recompilation 5 minutes
  - Database, ASM and GI is very robust
- But …
  - Found some optimizer issues with 11.2.0.2 after the upgrade …



Oracle 11.2.0.2
Linux 64bit

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Get the slides: blogs.oracle.com/UPGRADE

Upgrade your Database - NOW!

Ease your Oracle Database upgrades - Best Practices, Workshops, Projects ...

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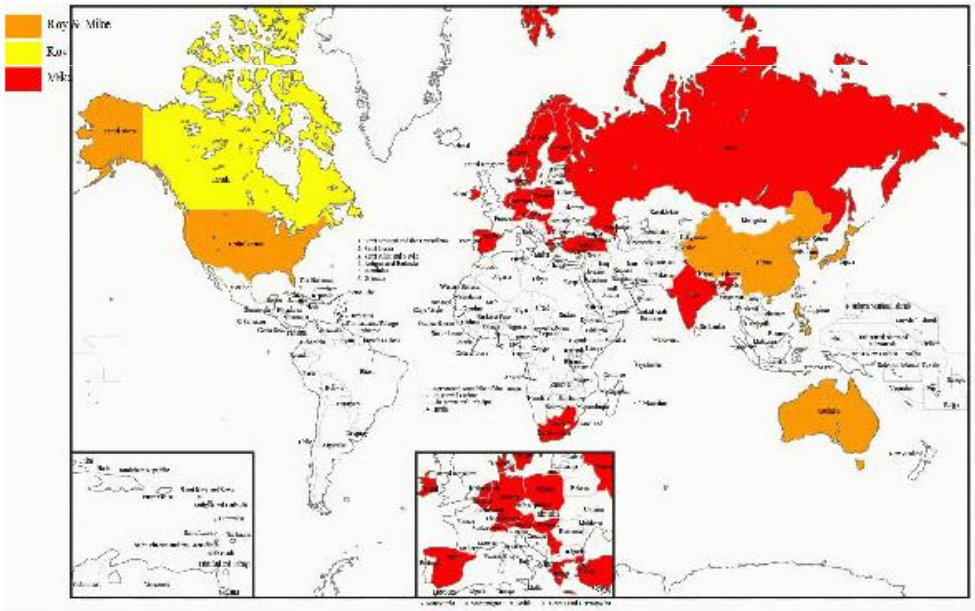
Thank you for your support throughout 2010!!!

By Mike Dietrich on December 23, 2010 6:40 PM

Now as the calendar year **2010** is close to its end, it's time for a quick wrap-up. The TV stations have shown all their flashbacks already in early December but we'll wait until end of the year ;-)

I will post some **pictures** done by Roy or me throughout our travel in the next days. We've visited a lot of countries - and did **more than 60 full-day Upgrade Workshops** in **28 different countries:**



About

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Working out of the **Oracle's** Munich office in Germany acting as interlink between customers and Oracle's **Upgrade Development**.
You'd like to connect with me?
LinkedIn or **XING** :-)

Slide Downloads

Upgrade to Oracle 11.2
Upgrade Workshop +500 Slides
Keyword: **upgrade112**

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Summary

- Upgrade to Oracle Database 11*g* & 11g Release 2 is easy
- Stable database release
- Great features
- Let's go ... :-)

- Any questions – would you like to become an Oracle 11.2 reference customer? Let us know about your upgrades ...
  - **Mike.Dietrich@oracle.com**
  - **Roy.Swonger@oracle.com**

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Credits

... to all the people inside and outside of Oracle who have provided most valuable input, corrections, recommendations, annotations, experiences!!! And to everybody who has visited one of our more than100 workshops since October 2008!!!

Many thanks to:

Marco Patzwahl (MuniQSoft GmbH), Paul Jones (Elsevier), Jurgen Plettinckx (TomTom), Kurt Van Meerbeeck, Fidel Vales ...

And many thanks to our colleagues from Oracle:

Raymond Dutcher, Mark Richwine, Mike Hallas, Antonio Flores, Kerry Sesker, Torsten Senft, Robert Pastijn, Zulfikar Qureshi, Prabhaker Gongoloor (GP), Leonidas Galanis, Pete Belknap, Takuya Abe, Kota Uchino, Mike Appleyard, Wachyu Danyanto, Roland Knapp, Larry "Murphy" Carpenter, Joseph Meeks ... and the whole Upgrade Development Group

(If your name is missing we apologize but we've just started this Credits slide on 10-AUG-2010, so more names will be added soon)

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